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AIR QUALITY IMPLEMENTATION PLAN FOR THE STATE OF ALASKA

VOLUME I: CONTROL STRATEGY

DECEMBER 1971

Prepared for the

STATE OF ALASKA
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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NOMENCLATURE

Symbol	Definition	Units
C	Urban size	L
CO	CO concentration at incipient black smoke	M/L^3
CO	winter idle emission efficiency	M/T
d	Distance attributed to a vehicle	L
d	Stack inside diameter	L
d_c	Average car length	L
d_h	Headway distance	L
D	Total delay ($D = T_{act} - T_{free}$)	T
D_p	Delay reduction time per peak period	T
D_r	Delay reduction time	T
D_t	Total delay reduction time per peak period	T ($D_t = 2D_pP$
h	Stack height	L
H	Height of the plume centerline when it becomes essentially level	L ($h + \Delta h = H$)
m_1	Dollars saved per peak period	
m_2	Dollars saved per peak two periods	($m_2 = 2m_1$)
m_3	Total dollars saved per day	($m_3 = 2m_2$)
m_4	Total dollars saved per year	
M_s	Miles saved	L
n	Number of samples	
p	Barometric pressure	F/L^2
Q	Emission density	M/L^2T (used in area model)
Q	Source emission rate	M/T (used in point model)
T_a	Absolute ambient temperature	°K
T_{act}	Average actual trip time	T

T_{free}	Free flow trip time	T
T_s	Absolute temperature of stack effluents	^oK
u	Wind speed	L/T
V	Stack effluent exit velocity	L/T
V	Volumetric flow rate at idle	L^3/T (10 ft^3/min)
V_1	Vehicle volume	Vehicles/L
V_2	Vehicle volume - 1 direction	Vehicles/T
V_3	Vehicle volume	Vehicles/T
V_4	Vehicle volume - 2 directions	Vehicles/T
V_5	Peak quantity	Vehicles
W	Weight rate of effluents generated	M/T
x	Downwind displacement from source	L
x_{max}	Maximum ground-level concentration	M/L^3
$\bar{\bar{x}}_g$	Geometric mean	M/L^3
y	Crosswind displacement from source	L
z	Vertical displacement from source	L
ΔCO	CO reduction	M/L^3
Δh	Plume rise	L
ρ_L	Effluent density	M/L^3
σ_g	Geometric standard deviation	
$\sigma_x, \sigma_y, \sigma_z$	Standard deviations of plume	
χ	Air pollutant concentration	M/L^3

Definition of Units

L = length

T = time

M = mass

F = force

PREFACE

This document presents a control strategy designed to achieve and maintain air quality in Alaska that is within the National Ambient Air Quality Standards. The control strategy consists of a set of control measures and procedures to be carried out and enforced by the State and Regional Air Quality Control Agencies. This document is divided into two books. This book presents a technical summary of the Strategy. A second volume of appendices presents the technical details, including all calculations.

This book is divided into six major sections. Section 1. OVERVIEW OF THE CONTROL STRATEGY, presents an executive summary of the Strategy. It describes briefly the air quality problem in Alaska, it discusses the background for the problem solution and presents the control strategy. The subsequent four sections treat details of control Strategies for each of the four Alaska Air Quality Control Regions. These sections present, for each region, the region description, the existing regional air quality, the sources of pollutants, the proposed control strategy and finally the economic aspects of the control Strategy. The last Section 6. REFERENCES, gives a list of the documents and other sources of data from which the strategy was developed.

1. OVERVIEW OF THE CONTROL STRATEGY

1.1 INTRODUCTION

A control strategy is a time phased combination of specific control measures designed to achieve the total reduction of air pollutant emissions necessary for attainment and maintenance of national ambient air quality standards. The individual control measures that make up the control strategy are of many types, as deliniated in Reference 7. A few examples of measures considered for Alaska are: process and boiler emission limitations, a permit system to regulate construction and modification of new facilities, traffic control, fuel changes and street sweeping.

Alaska is a very large State with a relatively small population of only 300,000. Its population density is about 0.5 persons/square mile which is smaller than the United States average density by two orders of magnitude. Industrially, Alaska is in a developing stage and the industrial density is also relatively small.

The State population and industry is concentrated in the two areas around Anchorage and Fairbanks. About one third the population is located at Anchorage and about one sixth at Fairbanks. Likewise, industrial activities are centered around these cities.

1.2 ALASKAN AIR QUALITY CONTROL REGIONS

Alaska is divided into four Air Quality Control Regions, as designated by the Administrator of the Environmental Protection Agency and the Constitution of the State of Alaska. The boundaries of these control Regions are shown on Figure 1-1. The South Central and the Southeastern region are very sparsely populated. The Northern region is also sparsely populated, except for Fairbanks. The Cook Inlet region contains more than a third of the State population and about the same percentage of the industry.

As one would expect, the air quality for the most part of Alaska is relatively high. However, certain natural peculiarities of the area create air quality problems in Anchorage and Fairbanks. These peculiarities involve the facts that much of Alaska is a bed of glacial silt which is easily airborne when uncovered and very extreme temperature inversions that frequently exist in Fairbanks.

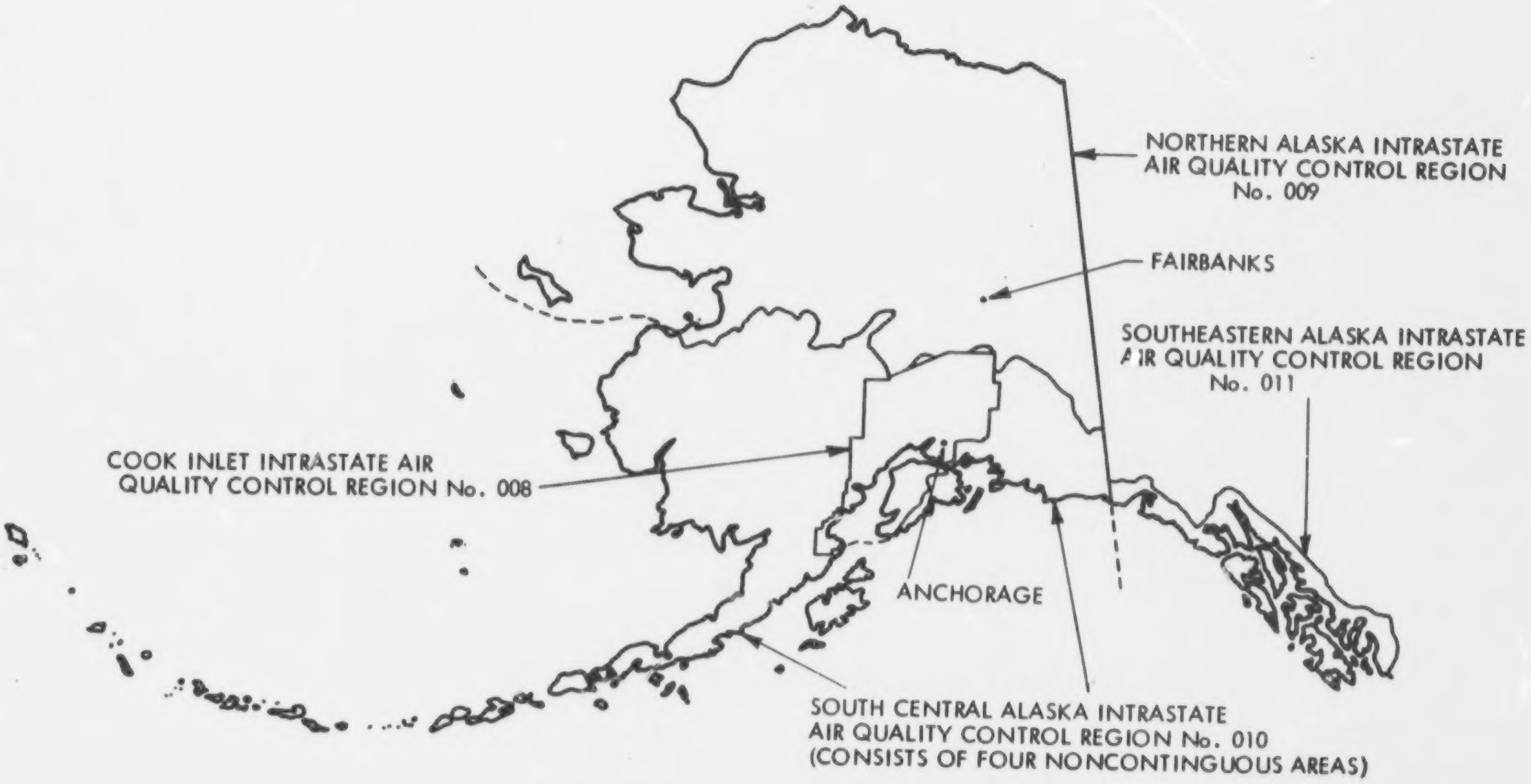
NORTHERN ALASKA INTRASTATE
AIR QUALITY CONTROL REGION
No. 009
FAIRBANKS
SOUTHEASTERN ALASKA INTRASTATE
AIR QUALITY CONTROL REGION
No. 011
COOK INLET INTRASTATE AIR
QUALITY CONTROL REGION No. 008
ANCHORAGE
SOUTH CENTRAL ALASKA INTRASTATE
AIR QUALITY CONTROL REGION No. 010
(CONSISTS OF FOUR NONCONTINGUOUS AREAS)

Figure 1-1. Air Quality Regions of Alaska

Measurements and visual observations of air quality outside the immediate area of Anchorage and Fairbanks show that its quality is well within the limits set by the National Ambient Air Quality Standards. Thus, these areas are classified as priority III for all pollutants.

Measurements of air quality in the Anchorage area have shown 24 hour average particulate concentrations of $711 \mu g/m^3$. This is to be compared with the secondard standard of $150 \mu g/m^3$. These data are to some extent questioned because the samplers were at only five feet elevation and therefore sampled both suspended and settleable particulate matter. Still, they show that a definite particulate problem exists. Anchorage is thus classified as priority I for particulates and priority III for all other pollutants.

Measurements of air quality in Fairbanks give very similar results. The annual geometric mean particulate concentration of $175 \mu g/m^3$ is to be compared with the secondary standard of $60 \mu g/m^3$.

The carbon monoxide measurements show one hour maximum concentrations of $81 mg/m^3$ compared to the primary standard of $40 mg/in^3$. These high carbon monoxide concentrations result when a steep temperature inversion exist and the ambient temperature is very low. Under such conditions shoppers and workers allow their cars to run continuously to keep them warm.

Thus Fairbanks is classified as priority I for particulate matter and for carbon monoxide. It is priority III for other pollutants.

The point sources of air pollutants in Alaska are located on the maps submitted in the attached folder. The location of proposed air quality surveillance sites are also shown. The legends explain the significance of the various symbols used.

Map I shows locations for all those sources outside the greater Anchorage and Fairbanks area. The boundary lines of the four Air Quality Control Regions are also shown on this map.

Map II is an expanded view of the Cook Inlet, and shows the locations of all sources independent of pollutant type. Companion Maps IIa through IIe show the location of sources by type. Map IIa shows particulate matter sources, IIb shows sulfur dioxide sources, IIc shows carbon monoxide sources, IId shows hydrocarbon sources and IIe shows nitrogen oxide sources.

Map III is an expanded view of Anchorage and shows the location of all sources independent of pollutant type. The companion Maps IIIa through IIIe show the location of sources by type, in the same order as listed above.

Map IV is an expanded view of Fairbanks and shows the locations of all sources. Maps IV a through IVe show, again, the location of sources by type in the order listed above.

1.3 CONTROL STRATEGIES DEVELOPMENT

The development of the implementation plan and specifically the control strategies sections were carried out within the guidelines of the Federal Register of 14 August 1971. This section describes how these guidelines were used in the development and selection of appropriate control measures for the State of Alaska.

1.3.1 Sulfur Oxide, Nitrogen Oxide and Oxidant Control Strategies

The guidelines covering the development of the control strategies for these pollutants are described in sections 420.13 and 420.14 of the above cited Federal Register. Neither ambient air quality measurements nor source emission inventories indicate that a problem existed with respect to any of these pollutants. Therefore, the control strategy proposed basically consists of an expanded air quality surveillance network and a permit system for the evaluation and control of construction of new sources of these pollutants.

The sole exception to this strategy type is in the area of sulfur oxide emissions from two power plants located in the Southeast Alaska AQCR. The sulfur oxide emissions from these plants cause localized ambient air concentrations in excess of the National Ambient Air Quality Standards (NAAQS). Specific control regulations requiring application of reasonably available control technology are proposed to limit these emissions and a program for developing and enforcing compliance schedule is presented as a part of the control strategy for this AQCR.

1.3.2 Particulate Control Strategy

In most areas of the State suspended particulate measurements and estimates are well below the secondary NAAQS. For these regions a preventive control strategy based on air quality surveillance and the control of construction of new pollution emission sources is proposed.

In two areas of the State, the greater Anchorage portion of the Cook inlet and the Fairbanks North Star Borough of the Northern Alaska AQCR, particulate concentrations above the primary national standards have been measured. A detailed procedure of control strategy development, as outlined in section 420.13 of the Federal Register, was applied to these cases.

In the greater Anchorage area, only a relatively small fraction of the suspended particulate loading can be identified with industrial/ commercial type sources of emission. Atmospheric diffusion estimates indicate that a majority of the particulate matter is caused by either natural sources of wind-blown dust or traffic generated dust from road ways. However, it was neither possible to quantify the contributions from these sources nor to assign a specific particulate matter background level to the region with the available data because the air quality data were made such that both suspended and settleable particulate matter were collected. The analysis indicated further that application of reasonably available control technology to stationary sources would not reduce ambient concentrations below the primary NAAQS.

The control strategy proposed consists of three basic sets of actions. First, regulations will require all stationary particulate emission sources to control to the extent of reasonably available control technology. This step is required in light of the measured ambient concentrations but, as stated above, will not be sufficient to reduce concentrations to acceptable levels. Second, a sequenced program of applying control measures to reduce traffic generated dust will be instituted. These measures are of the type listed for the control of fugitive dust in Reference 7 , Appendix B. Third, a detailed program of air quality surveillance and special studies to determine the effectiveness of controlling fugitive dust are proposed.

This air quality surveillance program will allow the control agency to refine the control strategy application periodically during the course of the implementation plan, and will allow maximum effort to be placed on the attainment of NAAQS by 1975.

In the Fairbanks North Star Borough the situation with regard to suspended particulate concentrations was roughly similar to that in Greater Anchorage area. However, the winter particulate levels in Fairbanks appeared, on the basis of atmospheric diffusion calculations, to be caused mostly by stationary sources. These sources will be controlled by regulations dealing with fuel combustion. stion.

The summer particulate levels and the annual average concentrations observed in Fairbanks appear to be significantly influenced by fugitive dust and/or smoke from forest fires. A phased application of fugitive dust control measures concurrantly with increased air quality sampling and special studies, to further define the problem, is proposed for this region.

1.3.3 Carbon Monoxide Control Strategy

In most areas of the state no carbon monoxide problem can be envisioned based upon either ambient measurements or source concentrations. However, in the Fairbanks North Star Borough extremely high levels of carbon monoxide have been measured. A detailed analysis of the problems, was applied based upon the guidelines supplied in Section 420.14 of the Federal Register.

The high ambient carbon monoxide levels appear to be caused by a combination of cold weather driving habits and limited diffusion potential of the atmosphere during prolonged inversion conditions. Thus, the problem seems to be specifically related to the unusual climatic conditions occurring in the Fairbanks area.

Development of a control strategies to this problem were affected by the pecularities of the area. The influence of the Federal Motor Vehicle Standards on the reduction of automotive pollution emissions were difficult to quantify since the best available estimates were based on urban driving conditions in moderate climates. The fact that Fairbanks is a relatively small urbanized area limited, to some extent the type of control measures, such as traffic rerouting in conjunction with mass transit, that could be considered in the problem solution. The ice fog problem, occurring at low temperatures, complicated the task of finding solutions since certain proposed control measures, such as switching motor vehicles to alternate fuels, aggravate the ice fog problem. The lack of a true measure of the temporal and spatial extent of the CO concentrations hampered the control strategy development.

The recommended strategy to control carbon monoxide in this area followed from the consideration of a number of possible control measures. The basic strategy called for a time sequenced set of control actions. These actions are designed to improve traffic flow in the down town area, reduce unattended idling time by regulation, by installation of electrical plug-ins for car heating and to switch to a Propane fuel if ambient levels do not improve within a two year period.

A keystone of the proposed control strategy is the continuation and extension of air quality monitoring for carbon monoxide in the Fairbanks North Star Borough. The monitoring data will be periodically reviewed to indicate progress made towards the solution of the problem and optimum control of alternatives to be implemented at any particular point in time.

1.3.4 Schedule for Compliance

The entire control strategy was designed on the basis that National Ambient Air Quality Standards will be achieved within three years following approval of the implementation plan. All identifiable stationary sources will be in compliance with the proposed emission limitations by the end of this time. The initiation of control measures, as described above for particulates and carbon monoxide, will allow considerable reduction in the pollutants emissions to be achieved within the three year period. The proposed control strategy provides sufficient checkpoints in terms of air monitoring quality and control strategy applications that a maximum possible result in terms of ambient air concentrations should be achieved.

1.3.5 Intra and Interstate Influences of Emissions Sources

Section 420.10 of the Federal Register requires that consideration be given to the impact of emission sources located in one region on ambient air quality in other areas. The air quality control regions are very large in Alaska and populated areas are separated by several hundred miles. There are no known or suspected instances where pollutant emissions in one region affect the air quality in another. Alaska's location makes interstate effects unlikely and the location of sources within Alaska makes international air quality degradation very improbable.

1.4 GENERAL FEATURES OF CONTROL STRATEGIES

1.4.1 Preventive Aspects

The control strategy for the State of Alaska as presented in the implementation plan will be evaluated as a strong preventive program with the exception of three areas where corrective programs are required. Most areas in the State now enjoy almost perfectly clean air. In only three specific cases are national primary or secondary ambient air quality standards thought to be exceeded. The desire to maintain this environmental quality will be achieved by rules and regulations of the State of Alaska proposed as part of this implementation plan. A set of strong emission limitations, are required to provide the basis for an environmentally sound development of the State's resources. The registration and permitting system gives the State and local air pollution control agencies the tools required to effectively protect the ambient air quality.

1.4.2 Use of Air Monitoring Studies

In addition to the general air quality surveillance system, each of the proposed special studies will supply information vital to the design or implementation of effective control measures. The detailed descriptions of these studies are presented in the Air Quality Surveillance Volume of this Implemental Plan; the specific application of these studies to the control strategy is discussed below.

The determination of the amount of automobile traffic-generated particulate material will significantly affect the particulate control strategy for both Anchorage and Fairbanks. If particulate road conditions and/or modes of vehicle operation are shown to be predominant in the generation of airborne particulate material, then a revision or realignment of the control strategy would be carried out. Conversely, if vehicle operations are not shown to be significant contributors to the regional suspended particulate problem, then other types of special air quality monitoring studies would be indicated.

The determination and evaluation relationship between sampler elevation and measured suspended particulate concentration will assist further control strategy development and implementation in two ways, First, these data will allow a more informed appraisal of the results of previously collected air quality data. Secondly, sampler elevation data should indicate to what extent particular sampling locations are influenced by nearby or distant pollution sources. In both of the above ways, the study defining the relationship between sampler elevation and suspended particulate measurement can assist agencies in evaluating the selected control strategy and may provide the basis for strategy revisions.

Measurement of the size distribution of suspended particulate material will further define the nature of the suspended particulate problem in Anchorage. The true health significance, in terms of amount of respirable dust, can be ascertained with these measurements. Also, the effectiveness of various control measures, both on a local scale and region-wide, can be judged on the basis of the particle size data. For instance, if a significant fraction of the total particulate loading is caused by particles 10 microns or larger in diameter, then sources in the immediate vicinity of the sampler (such as traffic) probably predominate since large particles are not generally transported over great distances in the atmosphere. A correlation of high dustfall measurements with high suspended particulate readings provides a similar indication, although in a more qualitative sense.

Each of the special studies will be an aid to the more explicit definition of the particulate problem in Anchorage and Fairbanks in particular and in Alaska in general. As each study is completed, it will be possible for the control agencies to more specifically plan appropriate control activities and to concentrate on those control strategies which are indicated to be most effective in terms of the actual suspended particulate problem.

The measurement of certain hazardous air contaminants (e.g., mercury, beryllium, lead, asbestos, etc.) as special monitoring studies will assist the control agencies in protecting the health of State residents. Although these pollutants are not specifically addressed in this Implementation Plan, control measures for them will be required in the near future. The background information gained from this study will be invaluable in assisting in the development of effective agency plans at that time.

Air quality sampling at remote locations will provide the operating control agencies with two direct benefits in terms of control strategies. First, background measurements obtained at locations relatively remote from existing sources or population concentrations provide excellent background information on naturally occurring pollutant levels. Agency personnel will also become familar with the topographic and meteorological peculiarities of the areas studied. Second, the impact of any proposed industrial developments in the regions sampled could be effectively evaluated. Each source's contribution to the existing ambient pollution levels could be estimated and the appropriate pollution control measures specified before an air quality degradation results. The necessity for measurements at selected remote locations is, therefore, obvious in terms of a comprehensive preventive control strategy.

1.4.3 Use of the Permit System

The proposed permit system described in the Permit System Volume of the Implementation Plan forms an integral part of the overall air pollution control strategy. The most carefully designed control strategy is of no value in achieving and maintaining National Ambient Air Quality Standards unless it is completely and universally enforced. This is the function of the permit system. The three basic areas in which the permit system facilitates the implementation of the control strategy are discussed in the following paragraphs.

First, the permitting of sources of atmospheric pollutant emissions provides the cognizant control agencies with a formalized mechanism for securing compliance of existing air pollution sources with air pollution control regulations. All sources affected by the control regulations must submit a registration application to the appropriate control agency. If the source has emission rates greater than those allowed by the regulation, the permit system provides for the negotiation and enforcement of a time schedule by which the source will reduce its emissions to the prescribed level. The use of the permit system in this context is more full described in the Permit System Volume dealing with compliance schedules.

The permit system, through its permit to construct provisions, provides an explicit method by which new sources (or modifications of existing sources) can be integrated into the overall control strategy.

The appropriate control agency must be informed prior to construction not only of the existence and location of the proposed source but also of those operational characteristics which affect air pollutant emissions. Detailed review procedures carried out both before construction and prior to operation will insure that all new sources comply with applicable emission limitations. The control agency will be able to determine, by means of the information supplied by the source operator for review, whether the construction and subsequent operation of the source is likely to degrade the air quality in the region to below secondary NAAQS.

After a permit is granted, it must be reviewed periodically, and this allows the agency to regulate operating sources in the same way. Thus, with proper administration of the permit system described in this plan, attainment of the NAAQS will be facilitated, and AQCR's which are presently classified Priority III will be prevented from exceeding the secondary standards.

1.4.4 Projections of Growth and Air Quality

Population growth projections were made for the greater Anchorage area and for the Fairbanks North Star Borough on the basis of projections of the Labor Department. The projected growth rate is 3% per year for both areas.

Air quality projections are based on projected emissions from stationary and mobile sources. The ground rule in determining emission reductions required to meet the NAAQS is to assume that all stationary source emissions increase at the rate of 3% per year as do mobile source emissions with the exception of gasoline powered motor vehicles. While the car population growth, is projected to match population growth; the carbon monoxide reduction, due to Federal Regulations on car emissions, is calculated for normal driving. However, the emissions inherent due to cold weather driving and idling are assumed to grow as the car population growth. This is a very conservative assumption, necessary because the Federal Regulation addresses driving conditions in a far more temperate climate and has an undefined impact on either extreme cold weather idling or driving.

1.5 SUMMARY AND CONCLUSIONS

1.5.1 Cook Inlet Intrastate AQCR

A 40% reduction in the concentration of particular matter in the Cook Inlet AQCR is required for meeting the secondary NAAQS. The air quality reduction cannot be related to a percentage roll back of point source emissions, since the major portion of the existing particulate concentrations result from natural causes and road traffic. Applications of reasonably available control technology are a recommended control measure. Road and street paving, road oiling, and wet street-sweeping are also recommended control measures, although accurate predictions of their effects cannot be made.

Control strategies for other pollutant species consist of preventive measures, such as fuel regulations and will be monitored by the permit system.

1.5.2 Northern Alaska Intrastate Air Quality Control Region

A 60% reduction in particulate concentrations is required to meet NAAQS. The causes and control measures discussed in Section 1.5.1 apply in Fairbanks. In addition, power plants are contributors, and reasonably available technology controls on stack emissions are recommended.

A 50% reduction in CO concentration is required in this AQCR. The high CO concentration in this region results mostly from cold weather driving and idling of automobiles. The Federal motor vehicle regulations for CO emission reduction will provide a 12% net reduction in emissions by 1975, and a 27% net reduction by 1977. Regulations will be adopted which prohibit unattended car idling which will result in a 15% reduction. Further a city by-pass highway to be complete in 1973 will reduce traffic and CO emissions by about 10%.

Control strategies for other pollutant species consist of preventive measures only.

1.5.3 Southwest Alaska Intrastate AQCR

The existing air quality in this region satisfies the NAAQS, and only preventive control measures are necessary.

1.5.4 Southeast Alaska Intrastate AQCR

High ambient levels of SO_2 occur in two localized areas, due to the presence of pulp mills. Emission limitations by regulations requiring reasonably available control technology will result in the attainment of secondary standards in these areas within the scheduled period for attainment of primary standards. This represents a 30% reduction (to secondary standards) in the ambient concentration of SO_2 in these areas.

Control measures for other pollutants in this region are preventive in nature.

2. THE COOK INLET INTRASTATE AIR QUALITY CONTROL REGION

2.1 REGIONAL DESCRIPTION

2.1.1 Topography and Climatology

This Air Quality Control Region is located in and around the Cook Inlet Basin. It consists of the Greater Anchorage Area Borough, the Kenai Peninsular Borough and the Matanuska-Susitna Borough. The basin is surrounded on three sides by high mountain ranges: the Alaska Range to the west and north, the Talkeetna Mountains to the northeast, the Chugach Mountains to the east, and the Kenai Mountains to the south. The basin opens into the Gulf of Alaska and the Pacific Ocean through the Cook Inlet. The Inlet which runs southwest from Anchorage, is 20 to 30 miles wide and about 100 miles long. The map in Figure 2-1 shows the boundaries of the AQCR. Three more maps showing the region in increasing detail can be found in the folder.

The city of Anchorage lies in a broad valley with adjacent narrow bodies of water. The Chugach Mountains to the east form an effective barrier to the influx of warm moist air from the Gulf of Alaska. The Alaska Mountain Range to the northwest and northeast acts as a barrier to the influx of very cold air from the north. Cold air entrapment in some suburban areas tends to offset this sheltering effect, resulting in occasional extremes of 25° with temperatures 15° to 20°F colder in the suburbs.

Seasons are well defined in Anchorage with winter extending from mid-October to mid-April. Winter is characterized by cloudy, mild weather alternating with clear, cold weather. The clear, cold days are frequently accompanied by significant ground fog caused by moisture from the arms of Cook Inlet. Snowfall occurs from mid-October to mid-April. Normally, the depth of snow cover on the ground does not exceed 15 inches. Strong, gusty winds occur infrequently during the winter months. Spring is the period following the "breakup." This season is characterized by warm days and chilly nights. Precipitation is negligible. Summer comprises the period from June through early September. The latter half of the season accounts for about 40 percent of the annual precipitation. Autumn is brief, beginning shortly after mid-September and lasting until

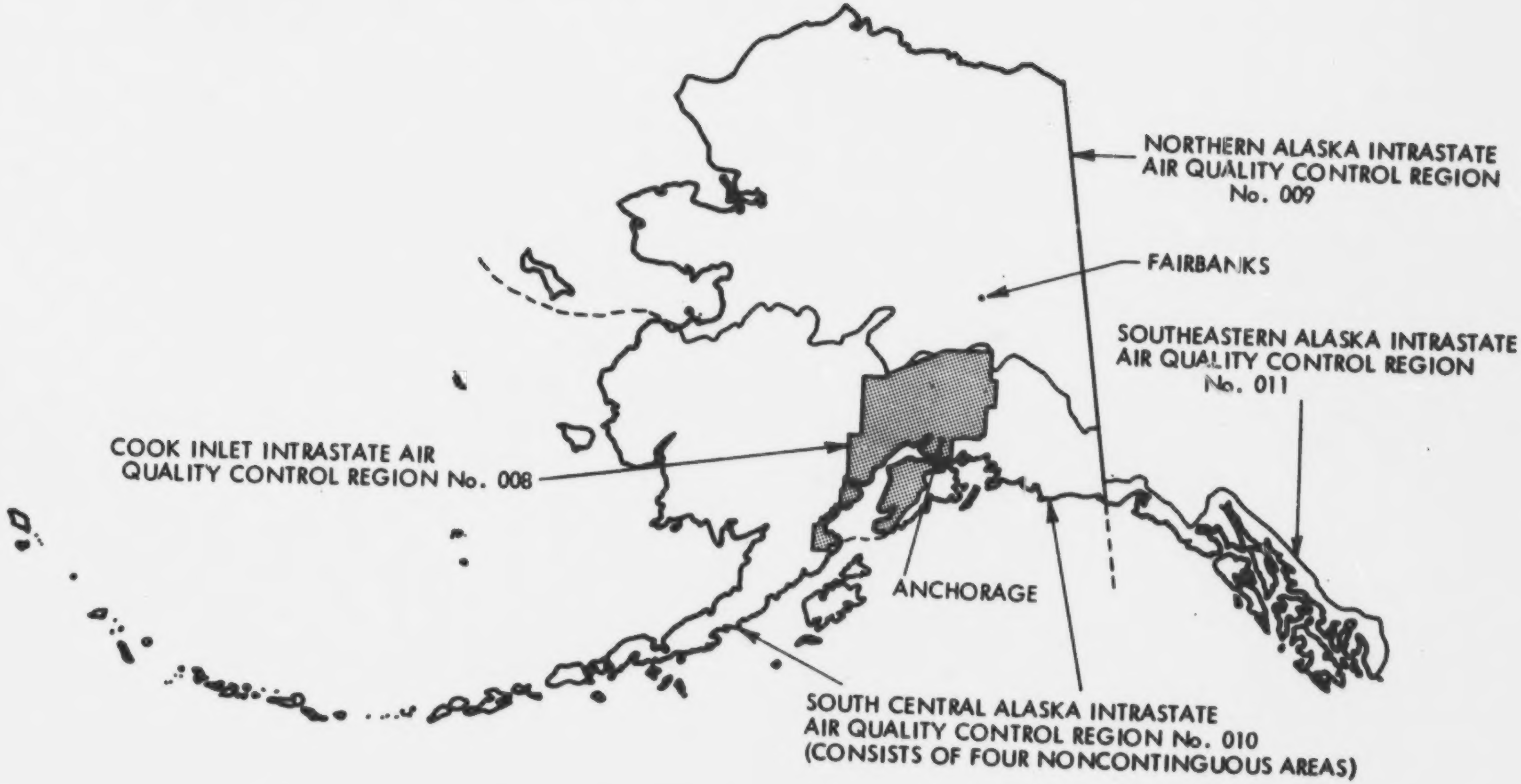
NORTHERN ALASKA INTRASTATE AIR QUALITY CONTROL REGION No. 009
FAIRBANKS
SOUTHEASTERN ALASKA INTRASTATE AIR QUALITY CONTROL REGION No. 011
COOK INLET INTRASTATE AIR QUALITY CONTROL REGION No. 008
ANCHORAGE
SOUTH CENTRAL ALASKA INTRASTATE AIR QUALITY CONTROL REGION No. 010 (CONSISTS OF FOUR NONCONTINGUOUS AREAS)

Figure 2-1. Air Quality Regions of Alaska—Cook Inlet Intrastate Air Quality Control Region No. 008

mid-October. Precipitation is limited and may occur as rain or snow. Some of the stronger southerly winds occur in late summer or fall.

2.1.2 Soil Characteristics

The soils in the Anchorage area are podzol soils found especially in regions having humid, cool climate (Reference15, p. 7). Podzolation to form soil of this type involves leaching of the upper layers with accumulation of heavier material in lower layers. The podzol soils have an organic mat and a thin organic-mineral layer above a gray leached layer resting on clay enriched alluvial horizon.* Thus, the upper layers of soil of the area tend to be sandy, grainy and loosely packed, characterized by a thin cover of loess and by sandy dunes (Reference15, p. 6). The well-developed podzol soils are ashy in appearance because of the extreme leaching of soluble salts and organic matter. Loess is small sized particulate material deposited by the wind; thus, like sand, it is readily blown by the wind whenever the ground cover is disturbed or removed.

2.2 PRESENT AIR QUALITY

The air quality control region is classified Priority I only for particulates. It is classified as Priority III for all other pollutants.

The air quality data available for this region are discussed and evaluated in the Air Quality Surveillance System Volume. Two maps included in that volume show the locations of the point sources in the air quality control region. The location of the major point sources are shown on the enclosed maps I, II, and III. The results of the air quality data evaluation are summarized and compared to the National Ambient Air Quality Standards in Table 2-1.

Air quality data relating to SO_x and NO_x are considerably below the primary national standard. No data are available for CO, hydrocarbons or photochemical oxidants.

The highest particulate concentrations were measured in the central part of Anchorage. The available air quality data are not sufficient to permit identification of all sources of suspended particles of dust, as discussed below, and the air quality surveillance system proposed in the

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*Alluvial horizon is a geological deposit of a certain time composed of fine sand or soil deposited by the wind.

Table 2-1. Air Quality Summary, Cook Inlet Intrastate Air Quality Region

Pollutant	Maximum Measured Air Quality	National Ambient Air Quality Standards		Priority Classification
		Primary	Secondary	
Particulate Matter	104 $\mu g/m^3$ x Annual Geometric Mean	75 $\mu g/m^3$ Annual Geometric Mean 250 $\mu g/m^3$ 24 hour maximum	60 Annual 150 24 hour	I
SOX	9 $\mu g/m^3$ xx 24 hour maximum	365 $\mu g/m^3$ 80 $\mu g/m^3$ Annual Arithmetic Mean	260 24 hour 60 Annual	III
CO	Not Available	10 $\mu g/m^3$ 8 hour maximum 40 $\mu g/m^3$ 1 hour maximum		III
NOX	19 $\mu g/m^3$ xxx Annual Geometric Mean	100 $\mu g/m^3$ Annual Arithmetic Mean		III
Oxidants	Not Available	160 $\mu g/m^3$ 1 hour maximum		III

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x Table 3.2.4 in the Air Surveillance Volume
xx Table 3.2.2 in the Air Surveillance Volume
xxx Table 3.2.2 - Elemendorf Air Force Base Data

Air Surveillance System Volume will provide information necessary to identify the sources of suspended particulate matter and to implement control measures leading to the desired air quality

The high particulate matter concentrations measured in the Cook Inlet region are related to the topography, meteorology and soil quality of the region, as well as to the man-made particulate emission sources identified in the Emissions Inventory (Reference 20).

National Air Surveillance Network (NASN) data for 1969 and 1970 and data from the Triborough Air Resources Management District for eight stations for March 1969 to March 1971 are available. The local data were sampled at an elevation of 5 feet; the NASN data at an elevation of 26 feet.

2.3 PROJECTED REGIONAL GROWTH

2.3.1 Population Growth

About 40% of the total population of the state of Alaska live in the greater Anchorage Area (References 10 and 25). The Department of Labor forecasts a population increase of 7.3% between 1971 and 1975 (Reference 4) while an extrapolation of the Greater Anchorage population growth (Reference 10), as shown in Figure 2-2, indicates a 17% population increase. However, much of the Anchorage population growth in the 1960's can be attributed to the expansion of the military bases -- an expansion that will not necessarily continue. The recent discovery of oil and the population increases that may be expected from the possible construction of pipelines will probably not be felt before 1975. In view of these factors a growth projection of 12% of the population and, consequently, of area source pollutant emissions was adopted as a ground rule in the evaluation of man-made emissions for 1975. This ground rule has little impact on the design of control strategies, as discussed later.

Growth rates of pollutant emissions from specific industrial and commercial source categories are discussed in the following section.

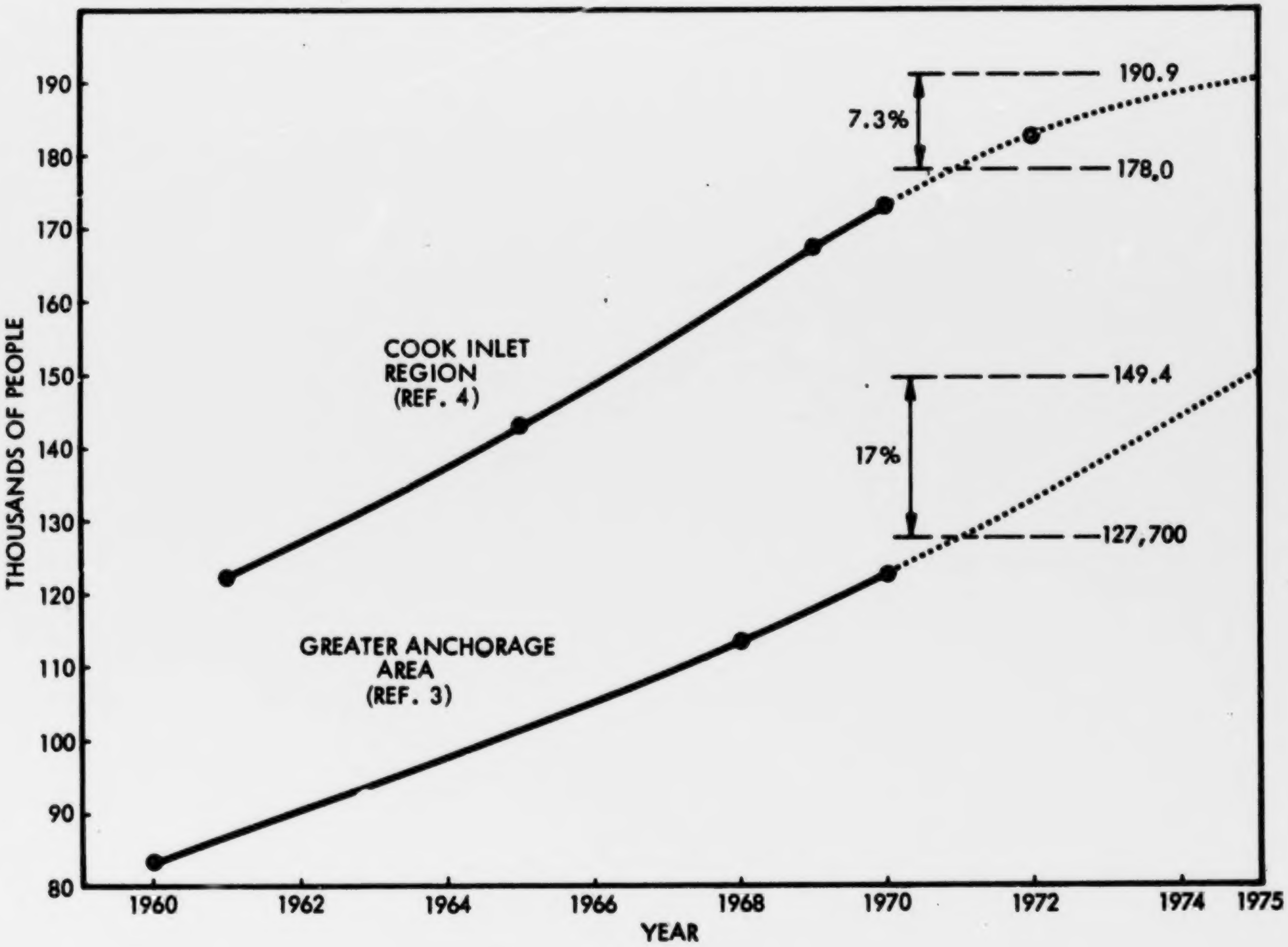

Figure 2-2. Population Growth in the Anchorage Area

2.3.2 Potential New Point Sources

Two new potential point sources of major size have been identified for the Cook Inlet area; a petroleum liquification plant and a cement plant.* The expected emissions from the former will involve considerable NOX caused by natural gas combustion in gas engines and/or turbines driving compressors. Up to 7,300 pounds of NOX can be expected to be generated for each mmcf of natural gas used in this manner. The actual size of the plant is undetermined at this time but its location has been established in the Kenai Peninsula area.

The cement plant, to be located in the Anchorage area, is projected to have a 1,300,000 bbl annual capacity. The particulate emissions from such a plant are typically 44-64 lbs/bbl uncontrolled, depending on whether a wet or dry process is involved. With available equipment which is about 99% efficiency, the potential particulate emissions would be approximately 285 to 415 tons per year.

Based on the above considerations, neither of the above sources appears to have a major impact on air quality in the Cook Inlet area. A summary description of these sources is given in Tables 2-2 and 2-3.

2.4 EXISTING SOURCES OF AIR POLLUTANTS

2.4.1 Particulate Matter

Examination of the man-made emission sources included in the Emission Inventory (Reference 20) shows that 76% of identifiable particulate emissions in the Cook Inlet area are attributable to transportation (Reference 20, page 22). The remaining 24% is caused by stationary sources. The total emission rate of particulates from point and man-made area sources not including traffic generated dust is 2626 ton/year (Reference 20, page 10).

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*Source of information: T. F. Borden, Deputy Director, Industrial Development Division, Department of Economic Development.

Table 2-2. Potential New Source Summary

Type of Operation:	Petroleum Liquification Plant
Firm Name:	Unknown
Probable Location:	Kenai Peninsula
Probable Process Rate:	Unknown; compressors to burn natural gas
Potential Air Emissions (Uncontrolled)	
NOX	200 - 7,300 lb/mmcf burned by either gas engine or turbines
Potential Air Emissions (Controlled)	Undetermined

Table 2-3. Potential New Source Summary

Type of Operation:	Cement Plant
Firm Name:	Unknown
Probable Location:	Anchorage area
Probable Process Rate:	1,300,000 bbl/yr
Potential Air Emissions (Uncontrolled)	
Particulates:	64 lb/bbl, dry process 44 lb/bbl, wet process
Potential Air Emissions (Controlled)	415 tons/yr 285 tons/yr

Table 2-4 shows the emission rates of all point sources in the region. The tabulation indicates all sources in excess of 10 tons per year, current emissions, and where applicable, the 12% growth rate projected for 1975. The allowable particulate emissions from fuel combustion were calculated on the basis of 0.3 lb/10^6 Btu of heat input (Reference 7, Appendix B). This figure is generally applicable to solid fuels, however, as the table indicates, the fuel used in the Anchorage area is primarily natural gas, a fuel which contributes relatively little particulate matter emission. Allowable particulate matter emissions were calculated on the basis of reasonably available control technology as defined in Reference 23, page 15495. As a result, the allowable emissions appearing in Table 2 4 are exceeded only in the case of source 72, a process source.

The locations of point sources emitting in excess of 100 tons per year of particulates or CO are shown in Figure 2-3. Of the point sources shown, four have particulate emission rates higher than 100 ton/year. One source is an oil platform (No. 30, Figure 2-3), flaring natural gas. Its particulate emissions contribute 5% of the yearly particulate emissions included in the inventory. Another particulate point source is the Elmerdorf Air Force Base Airport (No. 69, Figure 2-3). Its contribution to particulate emissions amounts of 10% of the total. The third source is the Anchorage International Airport (No. 1, Figure 2-3) which contributes about 21% of the total. The fourth source (No. 72, Figure 2-3) is the Collier Carbon and Chemical Plant. Its contribution of 201 tons/year is approximately 8% of the total. The influence of particulate emissions from the Collier plant on Anchorage is minimal because of the plant's remote location and the prevailing wind direction. The plant is located 60 miles southwest of Anchorage.

2.4.2 Carbon Monoxide and Nitrogen Oxides

An examination of the CO sources presented in the Emissions Inventory for the region indicates that almost all such sources consist of automobile and diesel emissions. Automobile contributions account for 85% of the NO_x emissions in Anchorage. In the overall Cook Inlet area, however, flaring of natural gas is a major contributor representing about 68% of the total on a region-wide basis. These flaring operations are

Table 2-4. Characteristics of Major Point Source Particulate Emissions

Source	Designation	Rated Capacity Million Btu/hr	Annual Fuel Consumption	Uncontrolled Emissions (tons/yr)	Actual 1970 Emissions (tons/yr)	1975 Emissions (tons/yr) with Present Controls	Allowable Emissions in 1975 with Reasonably Available Control Technology (tons/yr)
1	Anchorage International Airport	Not Applicable	Not Applicable	550	550	620	310*
2	Anchorage Municipal Light and Power	350	3245 mmcf	24	24	27	27
3	Atlantic Richfield Flare	178	1484 mmcf	13	13	No Flaring **	0
8	Chugach Electric Bernice Plant	150	6468 thousand gal	49	49	55	55
11	Chugach Electric Beluga Plant	300	3510 mmcf	27	27	33	33
26	General Service Administration	175	1107 mmcf	11	11	13	13
29	Merril Airport	Not Applicable	Not Applicable	13	13	15	15
30	Union Oil Mc-Carthna River Flare	2260	14, 332 mmcf	129	129	No Flaring	0
31	Mobil Amoco Granite Point Flare	1330	8416 mmcf	76	76	No Flaring	0
41	Shell-Amoco Middle Ground Flare	800	5050 mmcf	45	45	No Flaring	0
61	Union Oil-ARCO Trading Bay Flare	950	5912 mmcf	53	53	No Flaring	0
69	Elmendorf Air Force Base	Not Applicable	Not Applicable	257	257	330	330
70	Collier Carbon and Chemical (gas engines)	Not Applicable	10, 703 mmcf	80	80	92	92
71	Collier Carbon and Chemical	1063	7067 mmcf	64	64	70	70
72	Collier Carbon and Chemical	95, 820 lb/hr (process)	Not Applicable	201	201	224	141
76	Atlantic Richfield Sparks Platform	Diesel	1330 million gal	17	17	19	19
93	Union Oil Monopod Flare	1280	7300 mmcf	66	66	No Flaring	0
97	Union Oil Grayling Platform Flare	194	1100 mmcf	10	10	No Flaring	0

*Estimated that the Federal proposed aircraft emissions standard for visibility will reduce particulate emissions by 50%.

**Flaring operations will cease in accordance with regulations.

relatively remote from populated areas and do not contribute significantly to the higher measured concentrations found in the city. As mentioned above, they will be terminated during 1972 and are not considered further in the control strategy development.

2.4.3 Sulfur Oxides

Only four point sources of sulfur oxides are found in the Cook Inlet AQR. Two of these, (No. 29 and 69) are airports, the other two (No. 76 and 94) are diesel installations on oil platforms in the Cook Inlet (see map A). The total emissions from these sources are insufficient to degrade air quality in the Cook Inlet AQR to the level of the secondary NAAQS.

2.5 IMPACT OF EMISSIONS ON AIR QUALITY

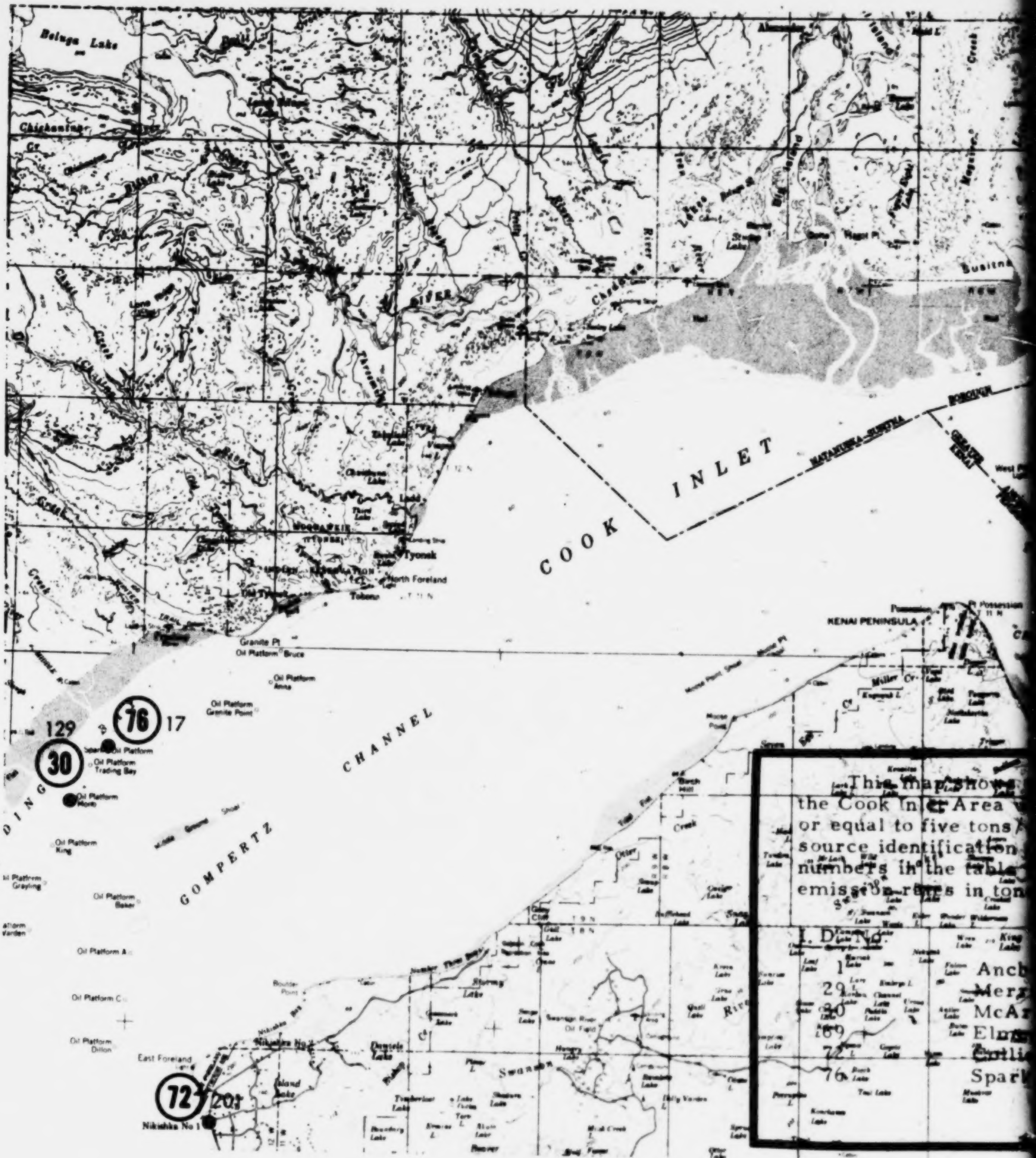
Conversion of pollutant emission rates to an air quality can be made using a diffusion model which treats each source separately, or by use of an area model (Reference 6, Appendix A). A diffusion model is not available for the Region, therefore the area model estimation procedure was used. The estimation is highly dependent upon the choice of the basic "urban area." Several reasonable choices are available, which includes the following three:

1) Area of the city of Anchorage, 129.5 km^2.
2) Area of Greater Anchorage, 184 km^2.
3) Area of "air shed" (Figure 2.4) which is bounded by the 1000-foot elevation line on the east the seashore on the west; and was selected straight east-west lines on the north and the south, 450 km^2.

A typical average wind speed for this area of 2.9 m/sec was used in the calculations (see Appendix 2A). The calculated air qualities corresponding to these urban areas, respectively, are:

$$= 27\ g/m^3$$
$$= 20\ g/m^3$$
$$= 10\ g/m^3$$

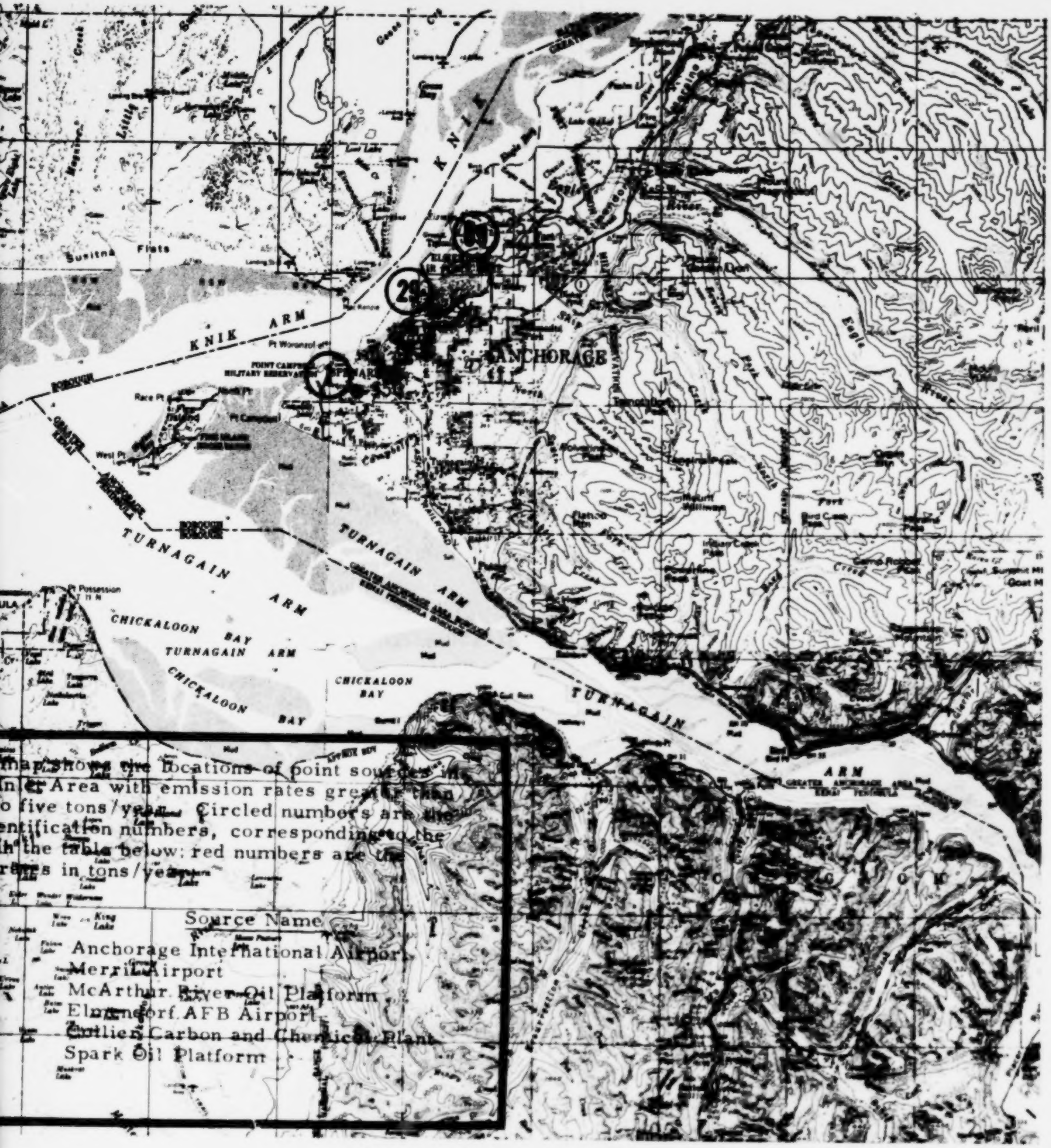
Much higher particulate concentrations are habitually measured in the downtown section of Anchorage which suggests that the calculation procedure is questionable. Several obvious shortcomings include our estimate of the urban size. The true area over which the pollutants are distributed is not really known. A second shortcoming is the knowledge


Beluga Lake
COOK INLET
GOMPERTZ CHANNEL
MATANUSKA-SUSITNA BOROUGH
Tyonek
North Foreland
Old Tyonek
Granite Pt
Oil Platform Bruce
Oil Platform Anna
Oil Platform Granite Point
Spark Oil Platform
Oil Platform Trading Bay
Oil Platform Monopod
Oil Platform King
Oil Platform Grayling
Oil Platform Baker
Oil Platform Dolly Varden
Oil Platform A
Oil Platform C
Oil Platform Dillon
East Foreland
Nikishka No 1
KENAI PENINSULA
Possession
Pt Possession
Susitna
Moose Point
Boulder Point
Stormy Lake
Daniels Lake
Island Lake
Swanson River
Miller Cr.
129
76
17
30
72
203

This map shows
the Cook Inlet Area
or equal to five tons
source identification
numbers in the table
emission rates in ton

I. D. No.	
1	Anch
29	Merr
30	McAr
169	Elm
72	Colli
76	Spark

A


KNIK ARM
KNIK
Susitna Flats
Pt Woronzof
POINT CAMPBELL MILITARY RESERVATION
ANCHORAGE
Race Pt
North Pt
Pt Campbell
West Pt
TURNAGAIN ARM
Pt Possession
CHICKALOON BAY
TURNAGAIN ARM
CHICKALOON BAY
CHICKALOON BAY
TURNAGAIN ARM
29
7

map shows the locations of point sources in
Inlet Area with emission rates greater than
o five tons/year. Circled numbers are the
entification numbers, corresponding to the
h the table below; red numbers are the
rates in tons/year.

Source Name
Anchorage International Airport
Merrill Airport
McArthur River Oil Platform
Elmendorf AFB Airport
Collier Carbon and Chemical Plant
Spark Oil Platform

Figure 2-3. Cook Inlet Area - Major Particulate Point Sources

B

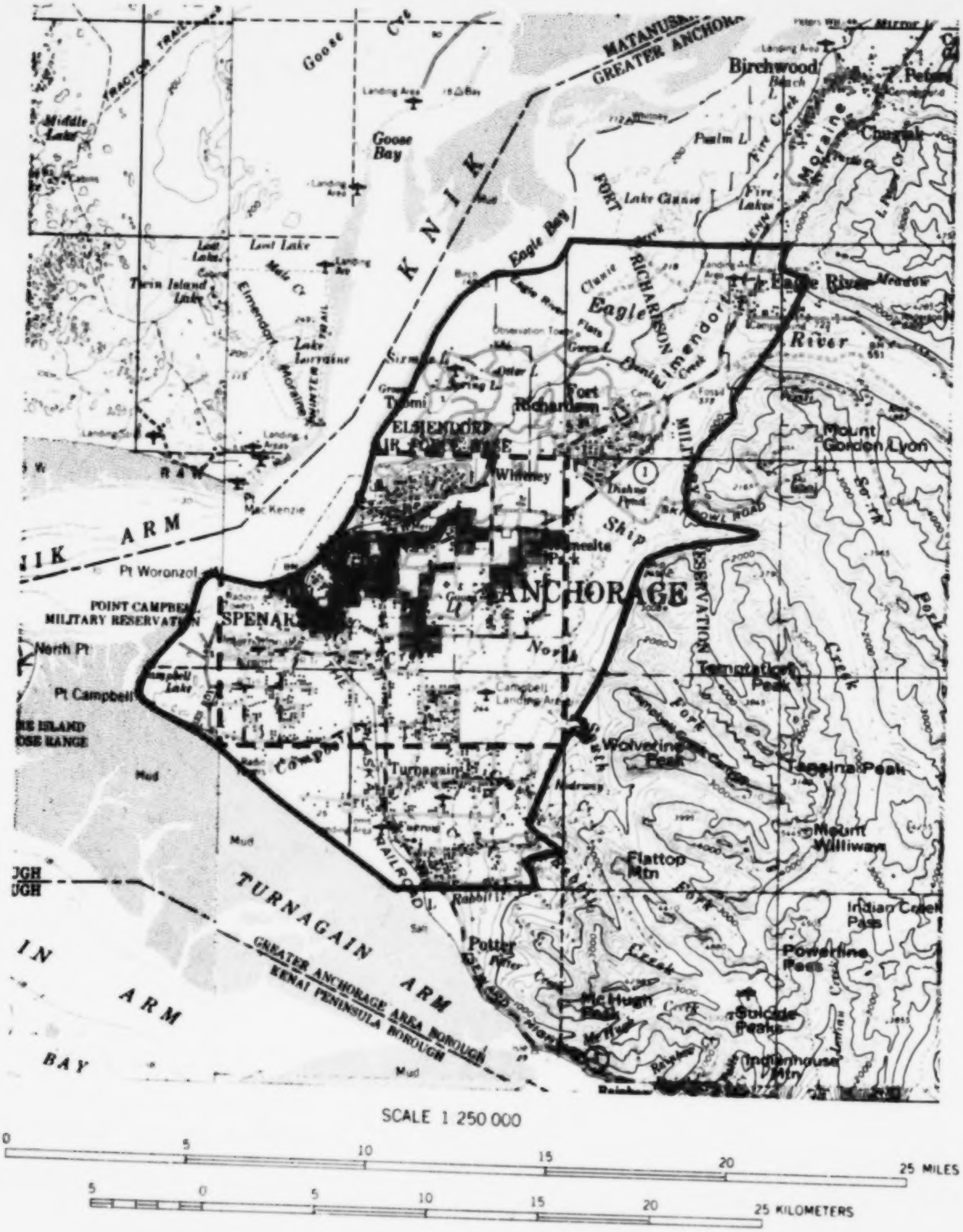

MATANUSKA
GREATER ANCHORAGE
Birchwood
Chugiak
Goose Bay
Middle Lake
Lost Lake
Twin Island Lake
Lake Lorraine
KNIK
KNIK ARM
Eagle Bay
Eagle River
Eagle
Fort Richardson
RICHARDSON
Elmendorf
ELMENDORF AIR FORCE BASE
Whitney
Mount Gordon Lyon
Ship Creek
ANCHORAGE
Pt Woronzof
POINT CAMPBELL MILITARY RESERVATION
SPENARD
North Pt
Pt Campbell
FIRE ISLAND
Campbell Lake
Campbell Landing Area
Temptation Peak
Wolverine Peak
Tanaina Peak
Turnagain
Mud
Mount Williwaw
Flattop Mtn
Indian Creek Pass
Powerline Pass
Rabbit Cr
Potter
McHugh Peak
Suicide Peaks
Indianhouse Mtn
TURNAGAIN ARM
GREATER ANCHORAGE AREA BOROUGH
KENAI PENINSULA BOROUGH
BAY
SCALE 1 250 000
0
5
10
15
20
25 MILES
5
0
5
10
15
20
25 KILOMETERS

Figure 2-4. Area of City of Anchorage (129.5 km^2) and Area of Greater Anchorage (184 km^2)

of all the sources of particulate water. Sources of particulates not included are traffic-generated road dust, dust from exposed soils or blown in from glaciers and moraines, and smoke from forest fires. The extent of the contribution made by these sources is examined in the following section.

2.5.1 Air Quality Data Implications

The suspended particulate measurements taken in Anchorage from 1963 to 1970 (Reference 6) are tabulated in Appendix 2B and illustrated in Figures 2B-1 through 2B-4. These data indicate that there are two seasons of the year in which a maximum particulate matter concentration occurs in Anchorage, spring (April/May) and the fall (September/October). As pointed out in Reference 12, this is a predictable pattern. The spring thaw comes in March and by April considerable road dust develops. Mud tracked in by motor vehicles and the dry road surface recreate a dusty condition. After the rainy season in June and July, the unpaved roads are graded in order to be smooth for the winter. Thus, the unpaved road surfaces are again a source of loose soil in September and October until a winter frost and snowcover begins. The minimum particulate count occurs during the winter months, November through March.

Table 2C-1 of Appendix 2C shows quarterly maximum and minimum particulate concentrations measured by the NASN. The average variation between maximum concentrations measured (second or third quarter) and minimum concentrations (first or last quarter) is 65%. Since no identifiable man-made source would account for such a variation, it is reasonable to conclude that about two-thirds of the suspended particulate in the Anchorage area may be generated by sources not considered in the Emission Inventory.

Examination of air quality data presented in Table 3.2.1 of the Air Quality Surveillance Volume, for the years 1957 through 1964 shows a marked decline in particulate concentrations during those years. This decline, achieved despite a large increase in population and in traffic volume, can only be attributed to the effectiveness of road and street paving in reducing suspended particulate concentration. However, the decline is not steady - indicating a considerable contribution from natural sources, such as volcano eruptions, and forest fires. The contribution from less predictable sources, such as dust blown in from moraines, silt beds and glaciers cannot be separated from traffic generated dust today.

2.5.2 Potential Sources of Particulate Matter

Top soil quality in the Anchorage area is such that a great deal of dust is generated wherever the soil surface is exposed. A large number of glaciers surround Anchorage. Moraines and silty river beds are potential sources of wind generated atmospheric dust.

Although there are few fires in the Anchorage area which could be classified as forest fires, periodic smoke emissions from distant fires do reach the area in the summer months. These emissions, coupled with considerable quantities of open burning during land clearing in the Greater Anchorage Area Borough, can make a significant contribution to the particulate concentration in the air. However, suspended particulate concentrations have not been shown to increase when visibility is decreased by a forest fire. In the one case where data is available, the fire was probably too far away (east of Fairbanks) to draw informative conclusions. Further investigations of these sources of particulate are necessary.

The traffic patterns that exist in the Anchorage metropolitan area reflect the land use patterns that have evolved in the community. Primary industrial and commercial activity is centered in the downtown business district and near the International Airport. The predominant land use in most of the metropolitan area is residential of various densities. Land use patterns are shown in Figure 2-5 (Reference 9). The traffic patterns presented in Figure 2-6 and 2-7 (Reference 26) indicate that the largest traffic volumes occur on main thoroughfares which interconnect the residential areas with the commercial/industrial areas and also those that serve the two military bases: Elmendorf Air Force Base and Fort Richardson.

An examination of Anchorage metropolitan area road maps and available information concerning the condition of roads in Anchorage (Reference 10) show that only 45% of the roads and alleys in the city of Anchorage and only 20% of the roads in the service areas of Spenard, Muldoon and Sandlake are paved. The main traffic thoroughfares presented in Figures 2-6 and 2-7 are paved but many of the roads in the residential areas leading onto the main thoroughfares are unpaved. In addition to city and borough maintained roads, there are many miles of private roads. Traffic produced dust which adds to the suspended particulate concentrations will be produced by vehicles on the unpaved roads within the central business district (CBD) and the residential and service areas. Additional dust will be carried into the city by vehicles that have been driven on unpaved roads.

Paved roads in Anchorage are quite dusty and, or course, traffic generates dust on the unpaved roads. A central strip of dust and dust deposits near curbs can be seen in the business district of Anchorage. Cars driving across the central strip or along the curb raise a cloud of dust, particularly if their speed is high. Similarly, access roads to the business district are dust producers. The center strip is covered with a thick layer of dust and the shoulders are unpaved. Any car straying from the center of a traffic lane, maneuvering to pass another car or to pull off the road, generates a great deal of dust. Unpaved roads, of course, are the biggest dust producers. Traffic on unpaved roads is generally no slower than on paved, and all cars raise large dust clouds. These sources of particulate matter cannot be quantitatively defined at this time.

A correlation between traffic-produced dust and suspended particulate concentrations in the Anchorage region is not available although an attempt was made to examine and correlate traffic flow and road surface conditions to dust production. The special studies proposed in the Air Quality Surveillance Volume will lead to a more definitive understanding of this phenomenon. When a correlation between dust fall and suspended particulate concentration becomes available from the special studies, a further correlation between road paving and suspended particulate concentrations will be possible.

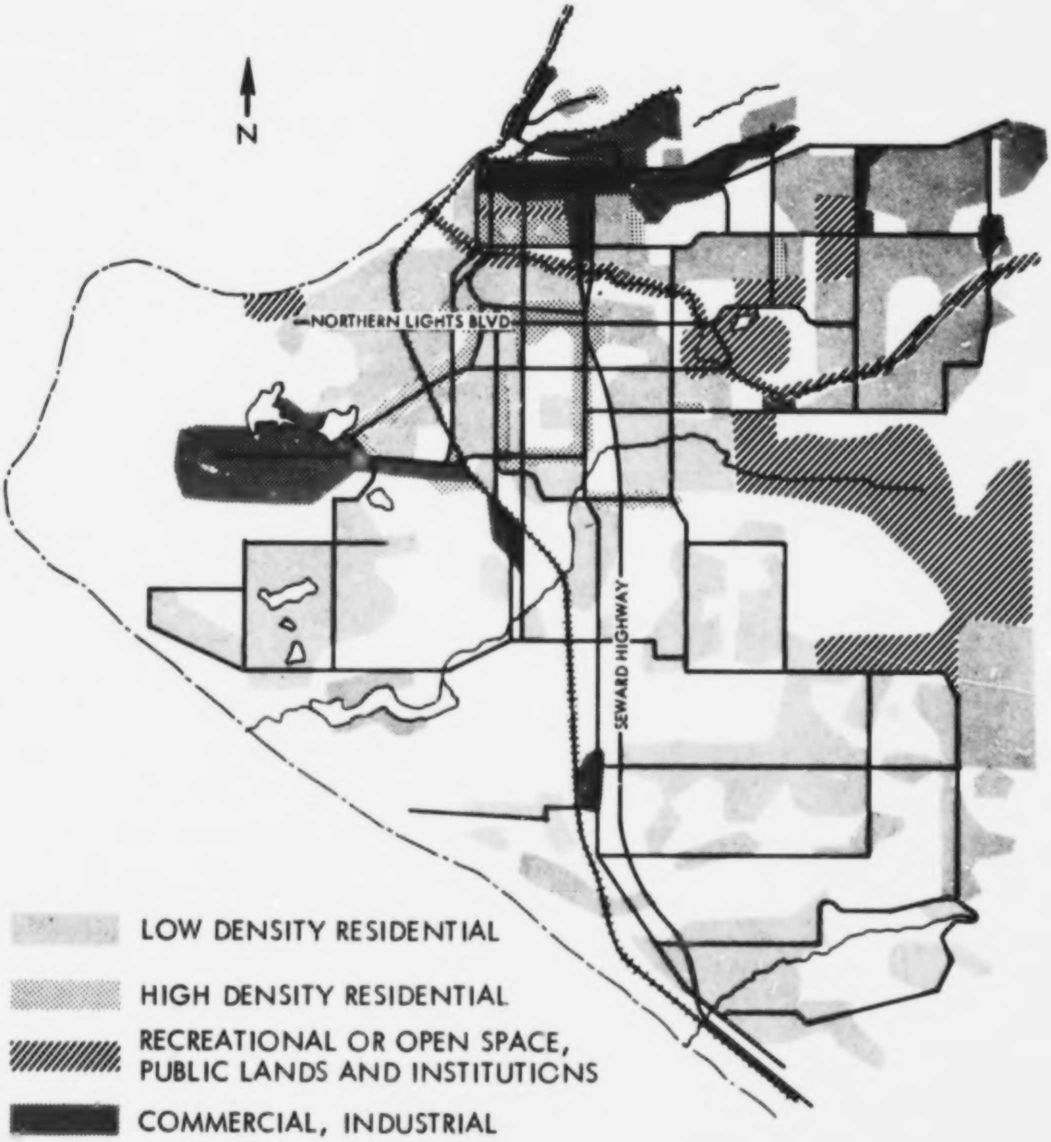

N
NORTHERN LIGHTS BLVD
SEWARD HIGHWAY
LOW DENSITY RESIDENTIAL
HIGH DENSITY RESIDENTIAL
RECREATIONAL OR OPEN SPACE, PUBLIC LANDS AND INSTITUTIONS
COMMERCIAL, INDUSTRIAL

Figure 2-5. Existing Land Use, Anchorage Metropolitan Area

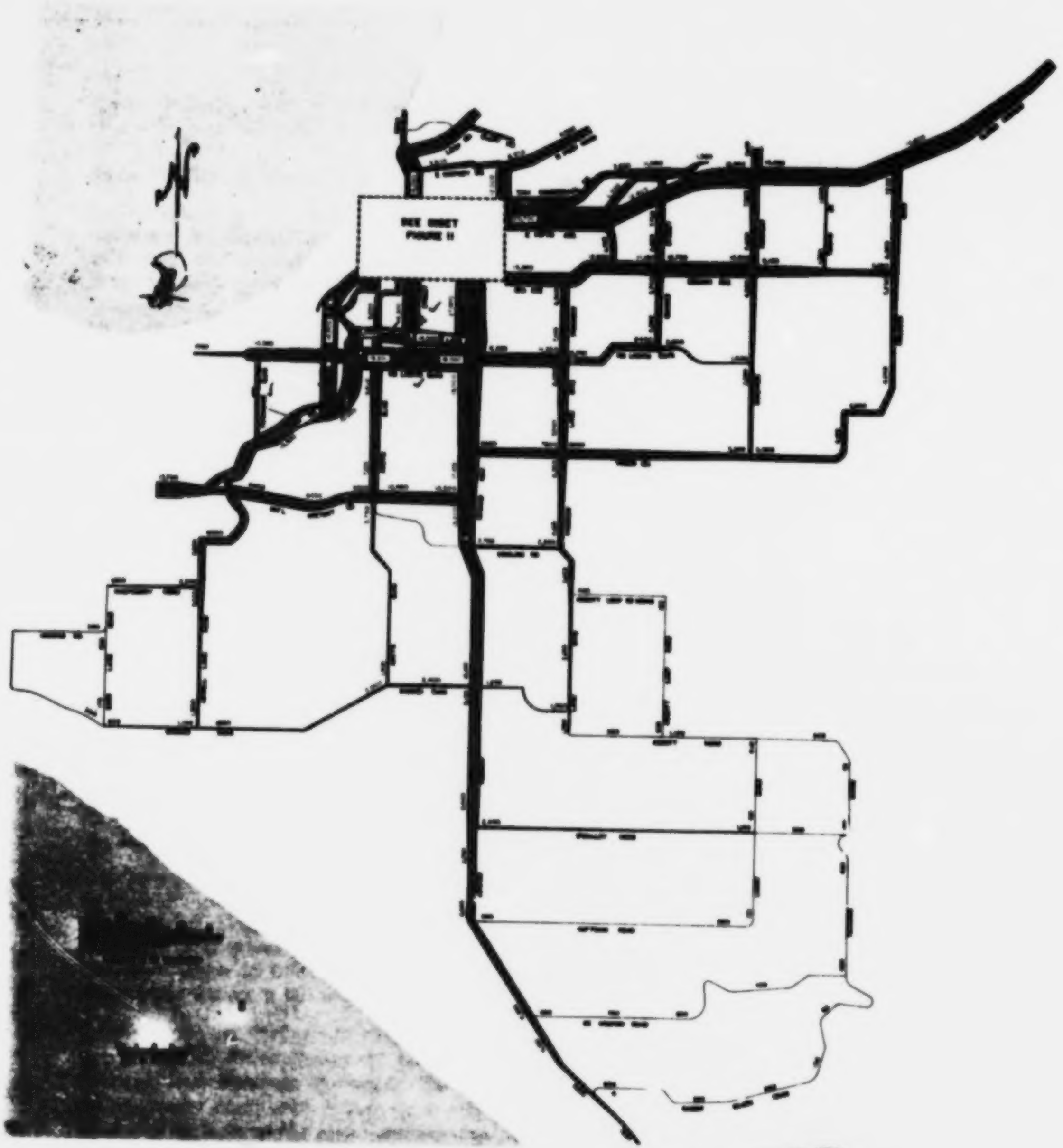


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Figure 2-6. Average Daily Traffic Volumes—1968, Study Area (Anchorage Metropolitan Area Transportation Study, Wilbur Smith and Associates)

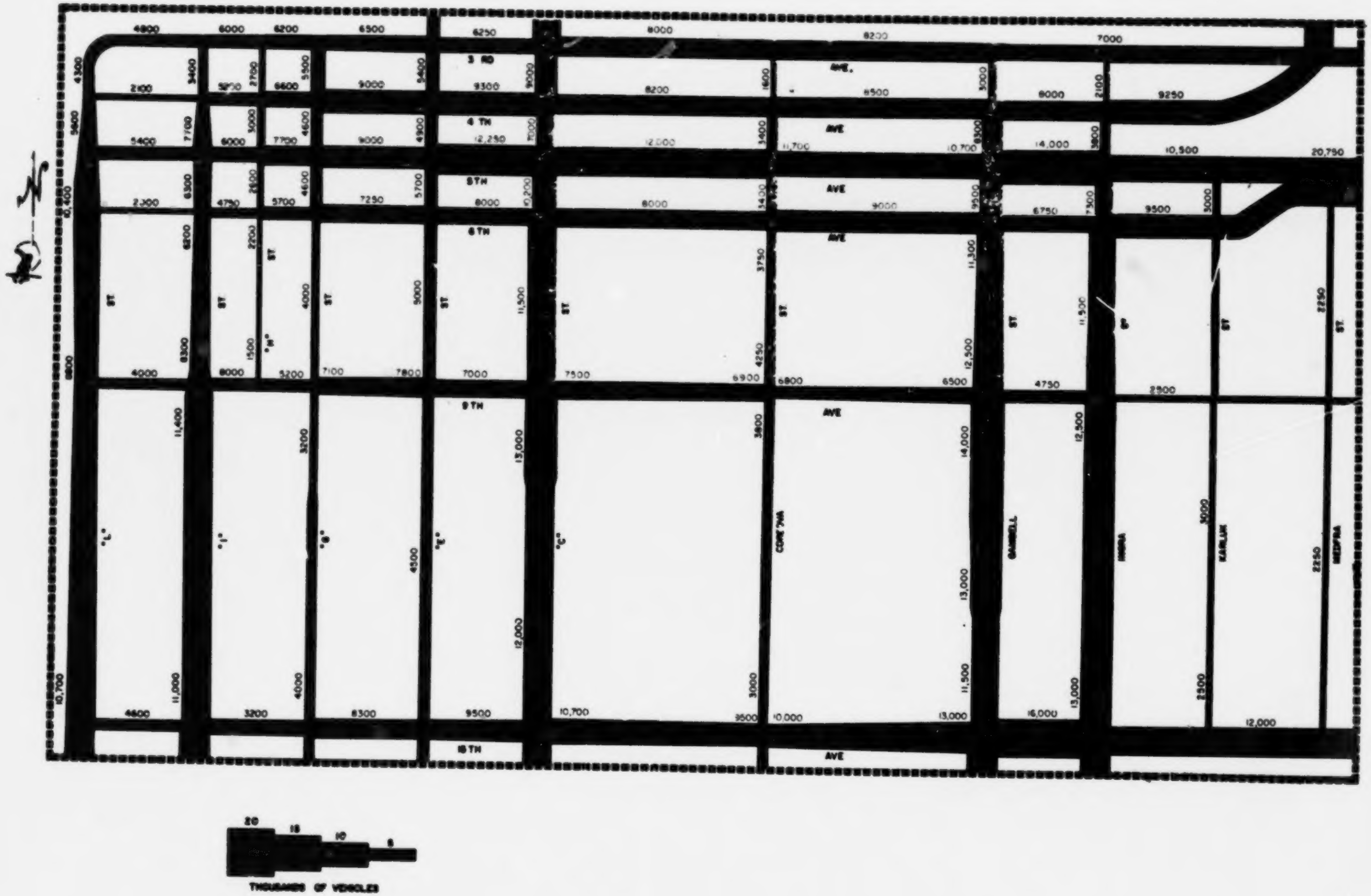
3 RD
4 TH
5TH
6TH
9TH
15TH
AVE
ST
"L"
"I"
"H"
"E"
"D"
"C"
CORDOVA
GAMBELL
INGRA
KARLUK
MEDFRA
20
15
10
5
THOUSANDS OF VEHICLES

Figure 2-7. Traffic Volume Flow—1968, Central Area (Anchorage Metropolitan Area Transportation Study, Wilbur Smith and Associates)

2.6 PROPOSED CONTROL STRATEGY

Measured concentration of particulate matter in Anchorage indicate mean annual values of about 100 $\mu g/m^3$. Thus a reduction of suspended particulate of about 40% is required to meet the Secondary National Air Quality Standard. Unfortunately, it is not presently possible to relate this improvement to a percentage roll back of pollutant emissions from sources because the background levels are unknown. Seasonal variations of about 65% of the measured concentrations between summer and winter indicate that a significant fraction of the observed particulate matter is caused by sources other than the conventional point and area sources. Traffic generated dust is probably the largest contributor, however an accurate quantification of the traffic dust contribution cannot be made with the available information. An aggressive control strategy is proposed in which reasonably available control technology is applied to industrial sources and a program of control measures are instituted directed at reducing traffic and other sources of dust. A special studies program will be carried along in parallel with application of these control measures which has the goal of accessing the progress of the plan and of further defining the air pollution problem. This control strategy will remain flexible so as to find solutions to the problems defined.

The proposed control strategy will achieve the secondary standard on particulate matter by 1975.

The control strategy is summarized below:

1972

Pave 17 miles of streets in Greater Anchorage Area Borough by 1973. This is in accordance with the Borough's paving plan as it stands today according to a communication from the Borough Planning Department. An increase in the paving schedule is not presently recommended since this is a very expensive measure ($40,000/mile) and its effectiveness is not clear.

Increase street cleaning frequency from May to September. Four wet street sweepers are currently operated in the Greater Anchorage Area. These sweepers operate for 8 hours/day, 5 days/week, covering a total of 28 miles of roadway per day. It is proposed that this operating schedule be increased so that at least 40 miles of streets are cleaned each day. This increased effort should be concentrated in the center city area and on major arterial streets. The exact schedules and routes will be negotiated between the Tri-Borough Air Pollution Control Officer and the Borough Road Maintenance Department.

- Oil soft road shoulders on main access roads and gravel roads between May and September. This extention of the current oiling program to include the soft shoulders of paved access roads will be initiated to attempt reduction in the amount of loose material carried onto hard-surfaced roads.

- Initiate a planting program on all lands from which ground cover has been removed (strips along roads, vacant lots, construction sites after work completion).

- Require street cleaning around construction areas where trucks track dirt onto public roads. Construction sites which require considerable hauling to and from the site will be subject to daily road sweeping to control dust resulting from truck load losses. Road sweeping will be performed in mid-morning and mid-afternoon on heavily traveled roads servicing the construction areas. Additionally, gravel hauling in these areas will be controlled by requiring dump trucks to provide a dust cover over the carriage. These restrictions will be in effect in the City of Anchorage and in the Muldoon, Spenard and Sand Lake Service Areas.

1973

- Evaluate dust fall and air quality data collected in 1972 (See Air Quality Surveillance Volume). Accelerate the most effective measures tried in 1972, and if feasible, replace sand-salf mixes on streets and roads in winter by 3/8-inch chips of quartz rock (such as used in Fairbanks). This would eliminate the approximately 10,000 tons of sand used annually in the Greater Anchorage Area.

- Continue the control measures instituted in 1972.

1974

- If Primary Air Quality Standards have been met, establish new schedules for paving, street cleaning, road and road shoulder oiling, to meet secondary standards.

- If primary standards have not been met, accelerate all programs to:

  1) Reduce unpaved road mileage to zero by 1975 for streets used by 1000 or more vehicles/day

  2) Clean streets downtown daily

  3) Oil road soft shoulders six times each year for all roads utilized by as many as 500 cars/day

  4) Require that exposed dirt during construction be covered as soon as feasible

  5) Require daily street cleaning around any construction

The above program, specifying a variety of control measures and annual progress reviews, is required because of the undefined nature of the suspended particulate problem in this area. Continual review of air quality data as generated by the air quality surveillance system and the special study will be essential in achieving the air quality standards by 1975.

2.7 ECONOMIC ASPECTS OF THE CONTROL MEASURES

The following cost estimates were derived for the recommended control strategies. The detailed calculations are given in Appendix 2E. The results of these calculations are shown in Table 2-5. These estimates have been provided by the appropriate governmental agencies (i.e., Alaska Department of Highways, Greater Anchorage Area Borough Department of Roads, etc.).

Table 2-5. Road and Street Maintenance Costs

	Cost/Mile	Frequency Times/year	Cost $/mile-year	Cost $/mile-year
Paving	$40,000.	1/5	$8,000	10,000
Resurfacing	1,000.	1	1,000	
Wet sweeping	10.	100*	1,000	
Grading	15.	2	30	2600-3900
Oiling	640.	4-6	2560-3840	
Oiling—road shoulder	215.	4-6	860-1290	860-1290

*Approximate number of days warm enough for wet-sweeping.

2.7.1 Costs of the Plan For the First Year, 1972, are as follows:

- Paving — No cost attributable to the implementation plan since this program is in accordance with the paving plan as it stands today.

- Increase in street cleaning by wet sweeping from 28 miles to 40 miles per day from May to September. Increment in cost (40 - 28) x 1000 = 12,000 dollars/year.

- Oil road soft shoulders and gravel roads. The current oiling program of gravel roads is not known accurately; schedules and miles oiled are largely determined by other demands on men and equipment. We shall assume that the increase in the oiling frequency for gravel roads is four times per year and that road shoulders will be oiled four times a year.

  Total number of unpaved roads in the Service Areas (Spenard, Muldoon and Sandlake): 102 miles, oiling costs are 102 x $2560 = 262,000 dollars/yr.

  Oiling of road shoulders on the following major roads is recommended:

  Glenn Highway and 5th Ave — from the CBD to Muldoon Rd. 3.9 miles.

  Seward Highway — from the CBD to Huffman 6.7 miles.

  Tudor Rd, Muldoon Rd — 6.9 miles.

  Boniface Parkway — from Thedor Rd to Glenn Hwy — 2.8 miles.

  Northern Lights Blvd. — between Boniface and Turnaagen 5.0 miles.

  Intl. Airport Road. — between the airport and Seward Highway.

  Debarr Road and 15th Ave — from the CBD to Muldoon Road 3.4 miles

  Total: 32 miles.

  The cost of oiling the 32 miles of road shoulders four times a year is 32 x 860 = 27,500 dollars

- Costs of planting cannot be estimated as no similar program under the climatic conditions of Anchorage exists today.

- Similarly no basis for the estimation of street cleaning costs around construction sites could be found.

  The total estimated cost in 1972 is 12,000 + 262,000 +27,500 = 301,500 dollars/year.

The costs of the proposed control strategy for the 1972-73 period were not made because the exact nature of the measures taken are so dependent upon the success of the 1972 measures.

Estimation of cost incurred in the installation of control devices on stationary or mobile pollution sources can be made with some degree of accuracy. Evaluating what portion of the cost of road paving and maintenance should be assigned to the implementation of the Clean Air Act is not so simple. As growing population concentrations are transforming what used to be a settlement into an urban center unpaved streets and roads become increasingly unacceptable. Increased mileage of paved roads and streets and increased maintenance go hand in hand with urbanization. The Clean Air Act requirements may speed up the process, but since the rate of the process cannot be projected in the first place (road paving programs and maintenance budgets are subject to citizen control), the future incremental cost can hardly be projected. The costs shown, then, are only useful as rough guidelines and the actual implementation of the proposed control measure must be closely coordinated with Borough Planning and Budgetary agencies. This will be a continuing process.

A thorough examination of expenditures and air quality improvement will be made periodically from 1972 to 1975. The results of the special studies, correlating dust fall and suspended particulate concentrations near roads will be used to determine the most cost-effective control measures, i.e., the amount of money expended to achieve a given particulate concentration reduction. The program for the following year can then be implemented with good assurance that the needed reductions in particulate concentration will be obtained without unnecessary expenditures.

3. THE NORTHERN ALASKA INTRASTATE AIR QUALITY CONTROL REGION

3.1 REGIONAL DESCRIPTION

3.1.1 Topography and Climatology

The Northern Alaska Intrastate Air Quality Control Region constitutes those portions of the 1956 Election Districts 18-23 which are not included in the designated Cook Inlet Intrastate Air Quality Control Region. The boundaries of the region are shown on Figure 3-1. This region includes the Fairbanks North Star Borough, which accounts for the bulk of the population and economic activity of the region. The remainder of the region has neither significant urbanized areas nor large air pollutant emission sources; therefore, the control strategy developed is for attainment of the NAAQS in this borough and maintenance of the air quality in the rest of the region.

Fairbanks is a city located on the Chena River, in a basin surrounded by hills on the northwest, north and northeast. The Tanana River plain lies south of Fairbanks and borders on the Alaska Mountain Range at the south. The Fairbanks area has the severe continental climate of interior Alaska. The sun is above the horizon for 18 to 21 hours each day during the months of June and July. In December the sunshine period declines to less than 4 hours per day (Reference 24). Temperatures in the summer reach about 90°F and fall to -60°F in the winter.

3.1.1.1 Wind Characteristics

The prevailing low level winds are north and northeast in winter (December, January, February), north in spring and fall (March, April, May and September, October, November), and southwest in the summer (Reference 3, Figure 5). Prevailing upper air winds, as measured at the Fairbanks International Airport, are from the east in winter and summer and from east or west in spring and fall. The surface winds are not strong, 2.3 m/sec average (Reference 3). The most striking feature is the number of calms, especially frequent and long in winter. Low level winds have been studied and measured in connection with winter inversions and ice fog (Reference 3).

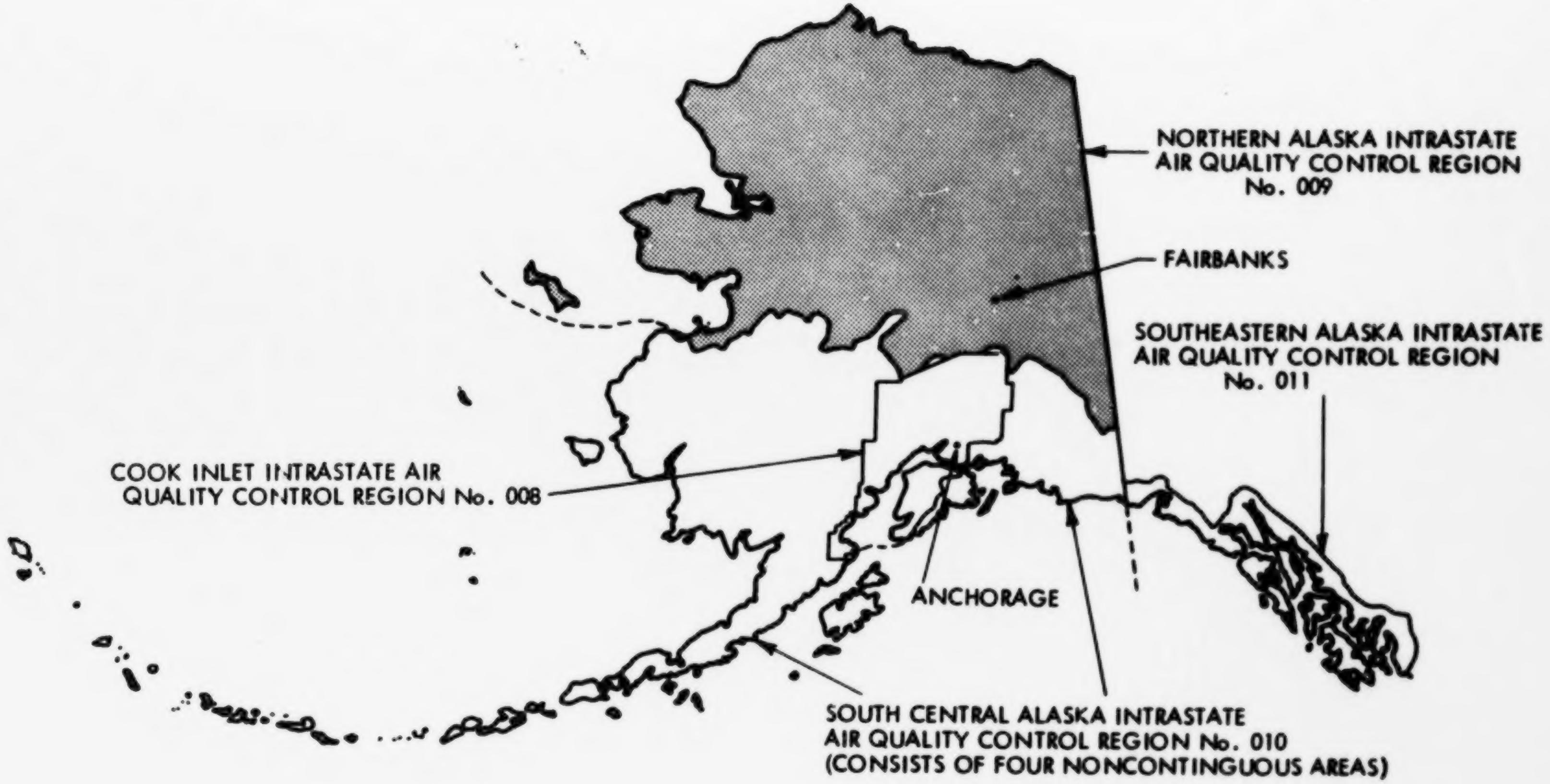
NORTHERN ALASKA INTRASTATE AIR QUALITY CONTROL REGION No. 009
FAIRBANKS
SOUTHEASTERN ALASKA INTRASTATE AIR QUALITY CONTROL REGION No. 011
COOK INLET INTRASTATE AIR QUALITY CONTROL REGION No. 008
ANCHORAGE
SOUTH CENTRAL ALASKA INTRASTATE AIR QUALITY CONTROL REGION No. 010 (CONSISTS OF FOUR NONCONTINGUOUS AREAS)

Figure 3-1. Air Quality Regions of Alaska—Northern Alaska Air Quality Control Region No. 009

3.1.1.2 Temperature Inversions

Temperature inversions are frequent and steep in the Fairbanks basin. Surface inversions are present in more than 60% of all night soundings the year round. During the dark months of December and January, when diurnal changes in weather are virtually nonexistent, surface inversions are present more than 80% of both day and night soundings (Reference 3, page 7). The Fairbanks inversions are among the steepest in the world (up to three times stronger than in Los Angeles). Moreover, the fairbanks inversions start usually at ground level, and are extremely persistent, existing often for weeks at a time. Under such extreme conditions, air pollutants tend to accumulate near their emission sources and the sharply restricted air volume available for their diffusion leads to high pollutant concentrations.

3.1.1.3 Ice Fog

Ice fog is formed when warm air carrying water vapor is injected into the atmosphere at temperatures below -35°C (-31°F). The ability of air to hold water vapor is decreased by three orders of magnitude when the air temperature drops from 100°C to -35°C (Reference 2). Ice crystals form rapidly when combustion exhaust gases are injected into the cold dry air because such gas contains abundant nuclei (small particulates and ions). Breathing also causes ice fog to form, as does water evaporation from heat rejected into river and cooling ponds. Ice fog is formed by a plethora of small ice crystals of about 10 microns diameter, which appears at temperatures below -35°C in populated regions where topography, combined with strong inversions, causes air to stagnate (Reference 2, page 1). Ice fog is not a pollutant according to the National Ambient Air Quality Standards. However, its appearance creates hazardous traffic conditions because of very low ("arm's length") visibility and coincides with the long, steep temperature inversion during which pollutants accumulate. High carbon monoxide concentrations have been also detected during steep clear weather inversions, indicating ice fog is not required for its accumulation. For example, a CO concentration of 71 mg/m^3 was measured in April 1971, on a clear day. The temperature on the ground was 20°F and the temperature inversion steep.[*] Thus, the highest concentrations do not necessarily coincide with ice-fog formation. Reduced automobile traffic in ice-fog may be one explanation. Lower carbon monoxide concentration on the ground may be caused by temperature gradients in the first 10-20 meters above the ground being reduced by the presence of the ice-fog; radiation starts at the top of the ice-fog layer rather than at the ground, and slow mixing currents increase diffusion of pollutants throughout the ice-fog layer.

3.1.1.4 Precipitation

Annual precipitation in the Fairbanks region is fairly light (12 inches). Rain showers begin in May and continue throughout the summer with a maximum in August. Precipitation amounts decline from September through the middle of December when snowfall increases markedly and reaches a maximum in January. Snowfall continues through March with persisten snow cover throughout the winter months. April averages the lightest precipitation and also realizes the greatest percentage of possible sunshine.

Freezing temperatures persist from the first of September through mid-May. Ice-fog and adverse air pollution conditions frequently occur with the extremely low temperatures during anticyclonic conditions. These conditions may persist for several days. Ice begins running in the Chena Slough at Fairbanks during October and remains frozen until the breakup in early May.

3.1.2 Soil Characteristics

Examination of the geologic map of the Fairbanks Quadrangle reveals that the city of Fairbanks is sitting on a "flood-plain alluvium" band of soil. Immediately to the north of the city is a plain of perennially frozen silt streaked with reworked creek gravel river beds. To the south, beyond the Tanana River, there are land slide debris and abandoned flood-plain alluvium and coarse gravelly facies. Every one of the above described soild will produce an abundance of dust when dry and exposed to wind. Ground cover does not grow back too readily in a near arctic climate and, though the hills around Fairbanks are forested, the lowlands are not.

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[*] Personal communication from Joe Holty.

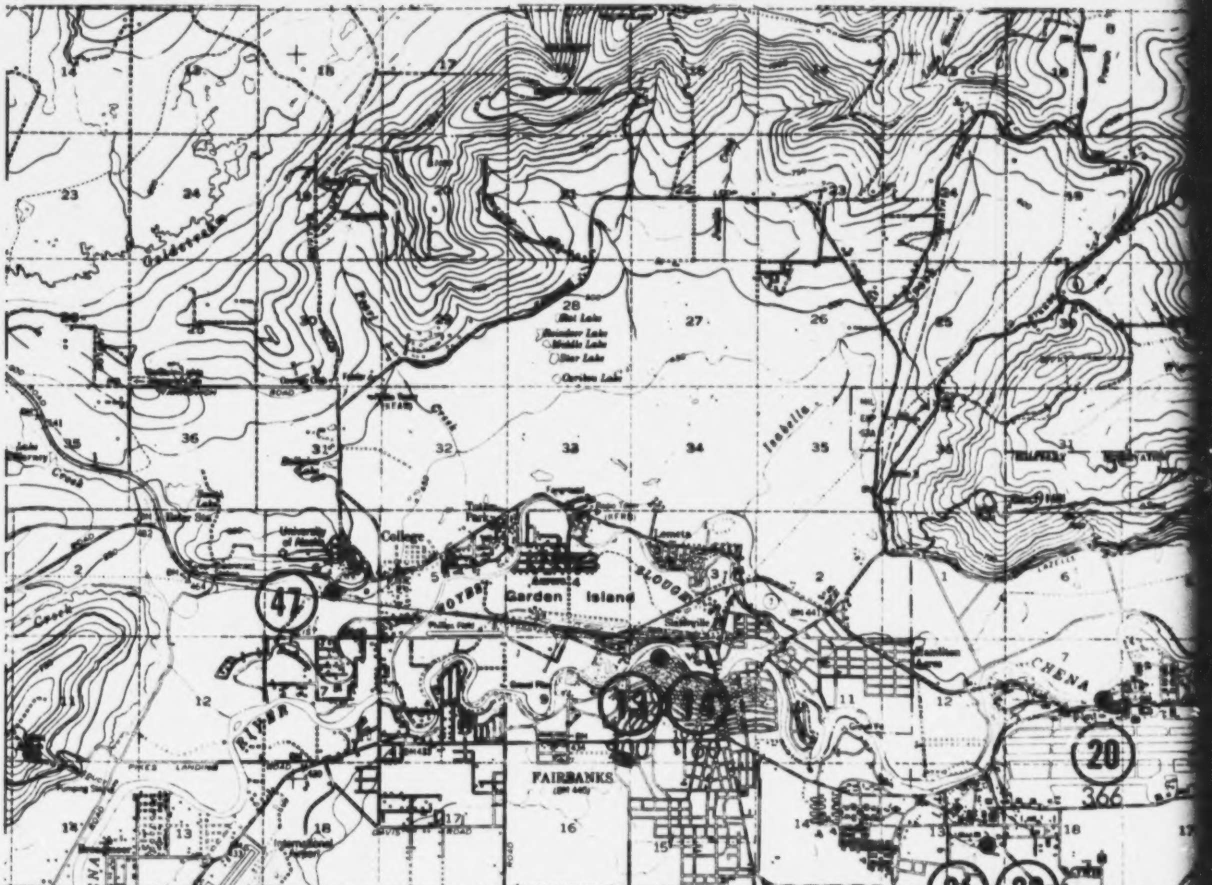
3.2 PRESENT AIR QUALITY

The air quality data available for this region are discussed in the Air Quality Surveillance System volume. The location of the major point sources in the air quality control region is shown on Figure 3-2. The results of the air quality data evaluation are summarized and compared to the NAAQS in Table 3-1.

Air quality data relating to SOX are considerably below the primary and secondary standards. The NOX concentrations are also below National standards. Primary standards are, however, exceeded for suspended particulate matter and for carbon monoxide according to measurements made in the central section of the city of Fairbanks. The Air Quality Control Region is therefore classified Priority I for particulates and for carbon monoxide.

The highest particulate and carbon monoxide concentrations were measured in the Central Business District (CBD) of the city of Fairbanks. However, the particulate concentrations measured at the Eielson AFB guardhouse (22 miles southeast of Fairbanks) are also excessive. The available air quality data are not sufficient to permit identification of all sources of suspended particulates. The surveillance system described in the Air Surveillance System Volume should provide information necessary to identify more closely the sources of suspended particulates.

The high particulate and carbon monoxide concentrations measured in the Fairbanks region are related to the topography, climate, wind conditions and soil quality of the region, as well as to the man-made stationary and mobile sources of pollutants identified in the emissions inventory (Reference20). The influence of climate on man-made pollution is particularly great under the extreme climate of this Borough.

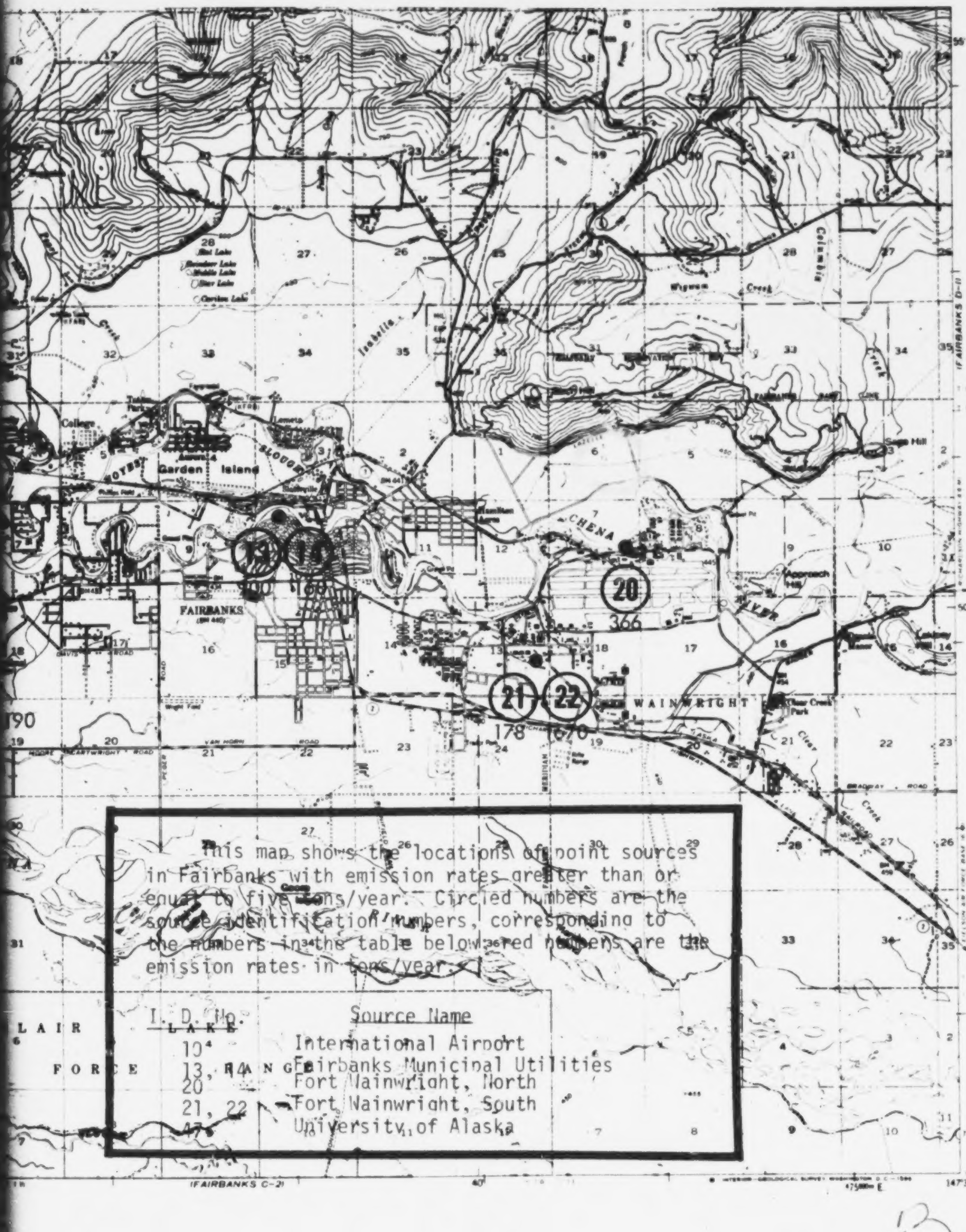

47
13
14
20
366
21
22
178
1670
10
190
College
Garden Island
FAIRBANKS
CHENA
RIVER
TANANA
BLAIR LAKES
AIR FORCE RANGE
(FAIRBANKS C-2)

This map shows the locations of point sources in Fairbanks with emission rates greater than or equal to five tons/year. Circled numbers are the source identification numbers, corresponding to the numbers in the table below; red numbers are t emission rates in tons/year.

I. D. No.	Source Name
10	International Airport
13, 14	Fairbanks Municipal Utilities
20	Fort Wainwright, North
21, 22	Fort Wainwright, South
47	University of Alaska

Figure 3-2a. Fai
Par

A

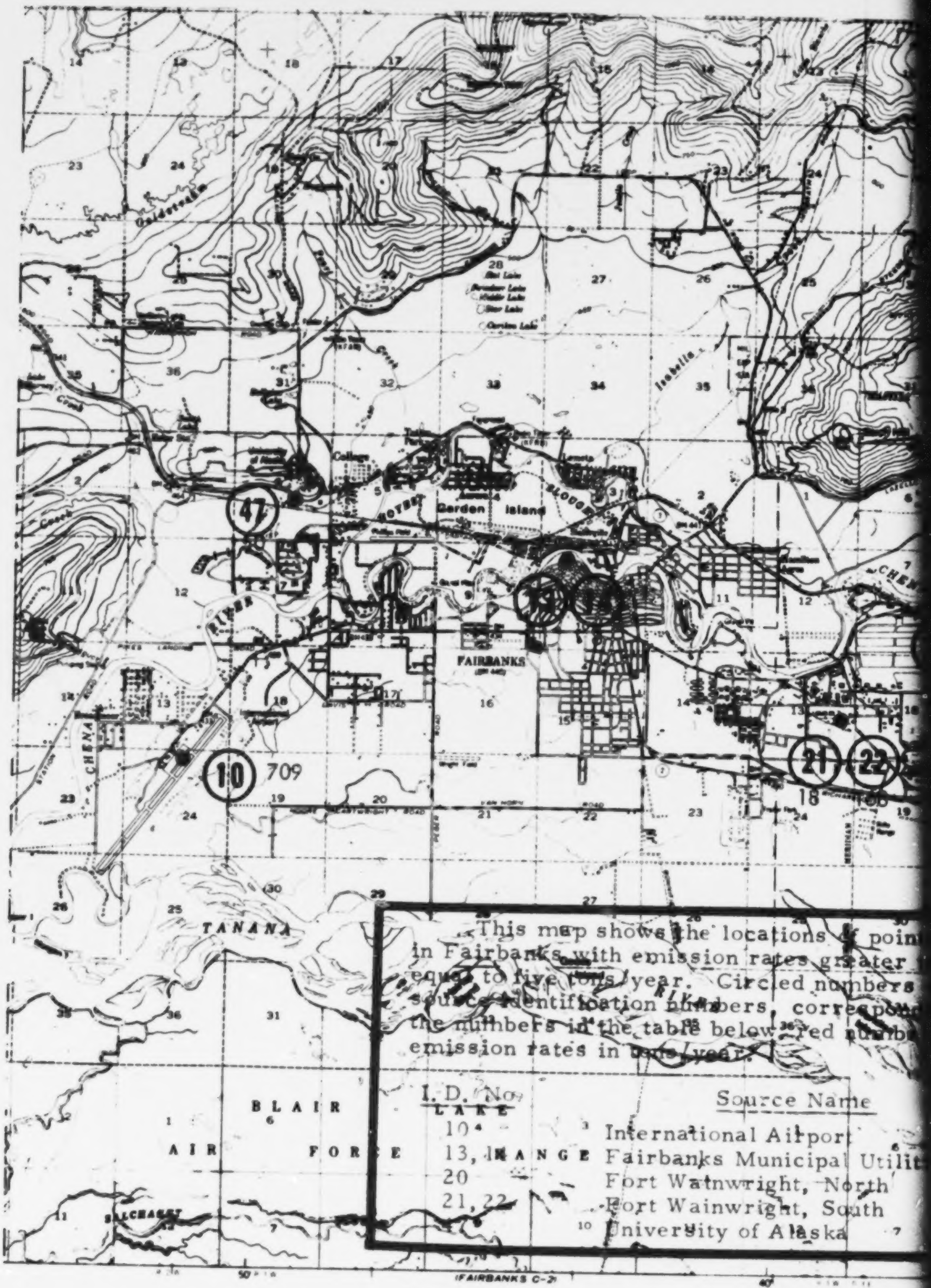

13
14
190
168
20
366
21
178
22
1670
190
College
Garden Island
SLOUGH
FAIRBANKS
CHENA
RIVER
WAINWRIGHT
Clear Creek Park
Columbia
Wigwam Creek
LAKE
FORCE RANGE
(FAIRBANKS D-2)
(FAIRBANKS C-2)
147°30'
64°45'

This map shows the locations of point sources in Fairbanks with emission rates greater than or equal to five tons/year. Circled numbers are the source identification numbers, corresponding to the numbers in the table below; red numbers are the emission rates in tons/year.

I. D. No.	Source Name
10	International Airport
13, 14	Fairbanks Municipal Utilities
20	Fort Wainwright, North
21, 22	Fort Wainwright, South
47	University of Alaska

13

Figure 3-2a. Fairbanks and Vicinity - Major Particulate Point Sources


47
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Garden Island
SLOUGH
FAIRBANKS
TANANA
RIVER
CHENA
BLAIR
AIR
FORCE
RANGE
(FAIRBANKS C-2)

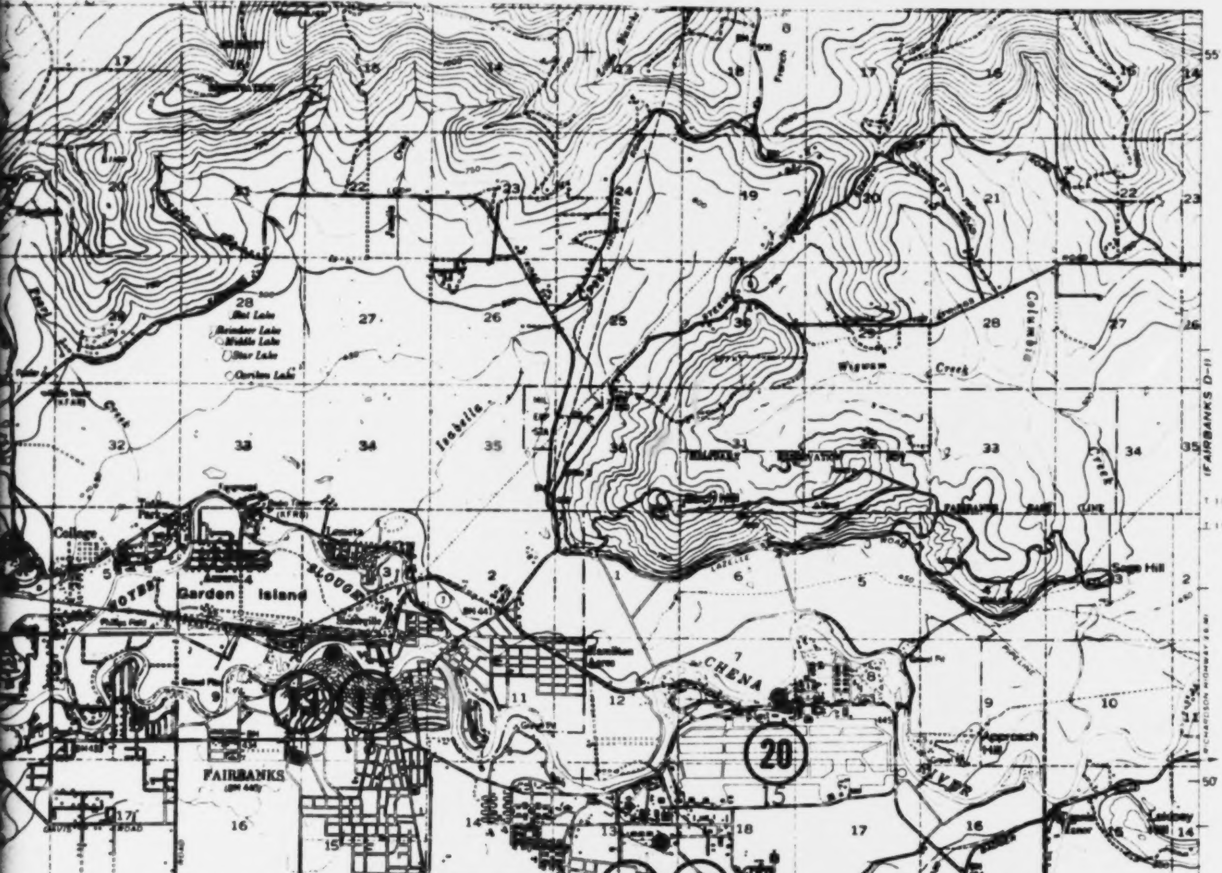
This map shows the locations of poin
in Fairbanks with emission rates greater
equal to five tons/year. Circled numbers
source identification numbers, correspond
the numbers in the table below. red numb
emission rates in tons/year.

I. D. No.	Source Name
10	International Airport
13, 14	Fairbanks Municipal Utilit
20	Fort Wainwright, North
21, 22	Fort Wainwright, South
	University of Alaska

Reproduced from
best available copy.

Figure 3-2

A


College
Garden Island
FAIRBANKS
CHENA
RIVER
WAINWRIGHT
20
15
21
22
18
66
(FAIRBANKS C-2)
(FAIRBANKS D-1)

This map shows the locations of point sources in Fairbanks with emission rates greater than or equal to five tons/year. Circled numbers are the source identification numbers, corresponding to the numbers in the table below. [illegible]red numbers are the emission rates in tons/year.

I. D. No.	Source Name
10	International Airport
13, 14	Fairbanks Municipal Utilities
20	Fort Wainwright, North
21, 22	Fort Wainwright, South
	University of Alaska

Reproduced from best available copy.

3

Figure 3-2b. Fairbanks and Vicinity - Major CO Point Sources

Table 3-1. Air Quality Summary
Fairbanks North Star Borough

Pollutant	Measured Air Quality	Primary Standard	Secondary Standard	Priority
Particulate	175 $\mu gm/m^3$ Annual Geometric Mean	75 $\mu gm/m^3$ Annual Geometric Mean	60 $\mu gm/m^3$ Annual Geometric Mean	I
SOX	107 $\mu gm/m^2$ 24 hr maximum	365 $\mu gm/m^3$ 24 hr maximum	260 $\mu gm/m^3$ 24 hr maximum	III
CO	81 mg/m^3 1 hr maximum	40 mg/m^3 1 hr maximum	—	I
NOX	96 $\mu gm/m^3$ Annual Arithmetic Mean	100 $\mu gm/m^3$ Annual Arithmetic Mean	—	III

[*] Air Surveillance Volume, Table 3.3.1

[**] Air Surveillance Volume, Section 3.3.1

Four years of suspended particulate data are available from the NASN Station in Fairbanks. These data are examined in Appendix 3 A in an attempt to isolate the influence of wind, precipitation and temperature on particulate concentrations and thus try to separate out the natural background concentrations from the man-made emissions. This attempt was not successful because the data are not sufficiently detailed. Some salient features of the available data are relatively low particulate concentrations in winter (75 to 100 $\mu g/m^3$) illustrating the combined effects of freezing temperatures, low wind speeds and snow cover. Highest concentrations are found in September of about 400 $\mu g/m^3$, the result of very dry weather and high winds.

3.3 PROJECTED REGIONAL GROWTH

3.3.1 Population Growth

Fairbanks is the second largest city in the State of Alaska. It is the sole trading center for a vast region and has a history of sharp but short-lived population growth increases. The growth rate was high at 7 to 8% per year in the 1950 decade, corresponding to the buildup of military establishments. Growth of about 2.5% continued between 1960 and 1964. The population then stabilized around 41,000 until 1968 (Reference 23). The Fairbanks area population was 60% of the total area population in 1969. The Labor Department projects continuing growth at 3% per year for that region between 1969 and 1975. The impact of the construction of an oil pipeline is not expected to be large before 1975. Thus, a 12% growth between now and 1975 will be accepted as a reasonable ground rule for emission rate increases of all sources other than automobiles when calculating projected air pollution emissions for 1975.

3.3.2 Potential New Point Sources

The establishment of the North Slope pipeline will constitute a major industrial development in this region. In addition to the local producing facilities, up to 12 pumping stations will be located along the length of the pipeline. Pumping stations north of the Brooks Range will be supplied with natural gas fuel. Stations south of the range will burn high grade distillate fuel which will be either transported to the stations or produced on site in a crude tapping unit. Pumping power will be provided by gas turbines in either case. The sulfur content of the distillate oil to be used is below 0.2% sulfur (Reference 7).

At design capacity, the crude tapping units will produce about 2,350 barrels of turbine fuel per day. Under normal conditions, off-gases produced in the process will supply most of the fuel for the tapping unit heaters.

A double chamber incinerator will be installed at each pumping station for disposal of solid waste, including sludge from the tapping plant. The maximum projected waste load for the station is estimated to be 154 pounds per day.

The estimated emission for such a pumping station* will consist of:

Particulates	44 tons/yr
Sulfur Dioxide	460 tons/yr
Carbon Monoxide	750 tons/yr
Nitrogen Oxides	575 tons/yr
Hydrocarbons	550 tons/yr

Evaporation losses from storage tanks will be minimized through the installation of vapor recovery units as required by the proposed air pollution regulations for the State of Alaska.

In addition to the oil pipeline, an oil refinery and a power plant are also scheduled for construction in this area. The refinery is to have 15,000 bbl/day throughput** Depending upon the sulfur content of the oil refined, SOX emissions without recovery could be as high as 1,500 tons per year if fluid catalytic cracking units are used.

The power plant, to be integral with the refinery, will be rated at 626 x 10^6 Btu/hour and is scheduled to use refinery and/or fuel oil. Uncontrolled particulate emissions could be of the order of 420 tons/yr (23 lb/1,000 gallons) and SOX emissions about 2,850 tons/yr (157 lb/1,000 gallons at 1% sulfur) if run on residual oil. The characteristics of these sources are summarized in Tables 3-2 and 3-3.

3.4 EXISTING SOURCES OF AIR POLLUTANTS

Examination of the man-made emission sources, (Reference 20) exclusive of traffic or climatologically generated dust shows that transportation contributes about 10% of particulate emission and 85% of carbon monoxide emission in Fairbanks (Reference20, pages 27 and 29). Power plants are a major source of particulates and a very minor source

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*Abstracted from Alaska Pipeline Environmental Impact Study.

**Information obtained from T. F. Borden, Deputy Director, Industrial Development Division, Department of Economic Development, State of Alaska.

Table 3-2. Potential New Source

Type of Operation:	Power Plant
Firm Name:	Energy Company of Alaska
Probable Location:	Fairbanks area in late 1975
Probable Process Rate:	Burning fuel oil and refinery gas 626 x 10^6 Btu/hr
Potential Air Emissions: (Uncontrolled)	Indeterminate - Unknown sulfur content of fuel

Table 3-3. Potential New Source

Type of Operation:	Oil Refinery
Firm Name:	Energy Company of Alaska
Probable Location:	Fairbanks Area
Probable Process Rate:	320.4 x 10^6 Btu/hr
	15,000 bbl/day throughput
Potential Air Emissions: (Uncontrolled)	(Maximum Values)*
Particulates	~840 lb/1,000 bbl of oil burned
SOX	~525 lb/1,000 bbl of fresh feed
CO	~13,700 lb/1,000 bbl of fresh feed
HC	~220 lb/1,000 bbl of fresh feed
NOX	~2,900 lb/1,000 bbl of oil burned

*Compilation of Air Pollutant Emission Factors, Environmental Protection Agency, preliminary document by M. J. McGraw and R. L. Duprey, EPA Research Triangle Publication, April 1971.

of carbon monoxide emissions. Automobiles are high carbon monoxide emitters and contribute somewhat to particulate concentrations through traffic produced dust.

3.4.1 Particulate Matter

The emission sources of particulate matter in the Fairbanks North Star Borough can be classified into point sources, such as coal burning power plants, and area sources consisting of smaller combustion sources, dust generated through road traffic, wind, forest fires or other phenomena having a large area distribution. These emission source categories are discussed in the following sections.

3.4.1.1 Point Sources

The major point sources of particulate matter considered to have an impact on the air quality of Fairbanks North Star Borough (sources 19, 28, and 38 listed for information purposes only) are listed in Table 3.4. Those over 100 tons per year emitting particulates and CO are indicated on Figure 3-2. Managers of all coal-burning sources were contacted by questionnaire during the Emission Inventory effort and indicated that they all use cyclones for emission control. Efficiencies reported varied from 70 to 94% at 10 microns. For the purposes of the control strategy, cyclone efficiencies of 84% are believed to be the maximum attainable and the numbers presented in the column "Actual 1970 Emissions" reflect this efficiency. As indicated, the actual 1970 emission sources (excluding airports) contribute about 6300 tons of particulate per year Though a projection of approximately 3% annual growh can be made for civilian sources, the phase-out of federal facilities, Fort Wainwright and the Eielson AFB, could also occur in the near future thus affecting the projection drastically. Transportation, other than aircraft, and area sources such as residential burning of coal and open burning, are estimated to account for an additional 750 to 1000 tons of particulates. Forest fires are estimated to contribute around 10,000 tons of particulates per year.

Table 3-4. Characteristics of Major Emission Sources, Northern Alaska Air Quality Control Region

Source Number	Designation	Rated Capacity (million Btu/hr)	Annual Fuel Consumption (tons/yr)	Uncontrolled 1970 Emissions (tons/yr)		Actual 1970 Emissions (tons/yr)	1975 Emissions (tons/yr) with Present Controls	Allowable Particulate Emissions in 1975 with Reasonably Available Control Technology (tons/yr)
				CO	Particulates			
8	Eielson Air Force Base – Aircraft	Not Applicable	Not Applicable	50	58	58	Unknown	58
9	Eielson Air Force Base – Coal Burner	1200	150,000	150	8482	420	470	387
10	Fairbanks Municipal Airport – Aircraft	Not Applicable	Not Applicable	709	190	190	220	110*
11	Fairbanks Community Hospital – Coal Burner	6	2426	2	73	11	13	6
12	Fairbanks Municipal Incinerator		3200	1	48	48	56	7
13	Fairbanks Municipal Utilities – Coal Burner	200	82,369	41	4500	900	1040	215
14	Fairbanks Municipal Utilities – Coal Burner	37	16,044	8	880	176	200	42
19	Fort Greely – Open Burning	Not Applicable	4500	191	36	36	Unknown	10
20	Fort Wainwright – Coal Burner	135	15,000	15	1219	366	Unknown	38
21	Fort Wainwright – Coal Burner	175	18,297	18	1487	180	Unknown	46
22	Fort Wainwright – Coal Burner	1200	166,240	168	13,700	1650	Unknown	421
28	Golden Valley Electric – Healy – Coal Burner	250	103,274	103	6377	955	1070	270
38	NASA	Diesel	651 million gal	106	8	8	9	8
47	University of Alaska – Coal Burner	100	50,000	50	3250	520	600	131

*Estimated that the Federal proposed aircraft emissions standard for visibility will reduce particulate emissions by 50%.

3.4.1.2 Area Sources

Based on the atmosphere diffusion calculations the conversion of coal-burning power plants to either natural gas or distillate oil would also present a meaningful strategy for the control of particulate emissions from these sources. Current plans call for a local refinery at Fairbanks if the pipeline project is undertaken. This will result in the availability of distillate oil for the power plants. In the case of natural gas, current plans call for the supply of such gas from the North Slope oil fields to pumping stations up to the Brooks Range. An extension of such a line to Fairbanks would mean an additional 200 miles of pipe. Although the use of distillate oil or natural gas could potentially increase the emission of water vapor, thus increasing the ice fog density, the relative merit of such conversion should not be discounted, since the reduction of water vapor emissions can probably be attained by technology under development. By conducting a development program to define the required design features of a water vapor condenser, this problem could conceivably be solved by 1975. The current experimental installation of such a device at the facilities of the Bureau of Land Management in Fairbanks is a step in this direction. Data from this installation will be available during this winter and maximum use should be made of such results to ascertain the operating characteristics of such a system.

The air quality data for Fairbanks has been discussed in preceding sections. Very high particulate concentrations have been measured in the CBD. However, few samples have been taken (in particular, few winter samples) and the inlet to the sampler for the NASN measurements was only 3 feet off the ground on the busiest street of Fairbanks. Better measurements are needed to fully evaluate the extent of particulate pollution problems and especially its spatial distribution. However, application of corrective measures must be initiated now and the control strategies modified as needed between 1972 and 1975.

The very large seasonal variation in measured particulate concentrations indicate that the contribution of blown-in and traffic-generated dust, and possibly open burning and forest fires is very large. The contribution of forest fires to the particulate concentrations in the summertime is believed to be significant. Shutdowns of the Fairbanks Municipal Airport have occurred on several occasions because of a lack of visibility resulting from distant forest fire smoke being blown over the city. The magnitudes of these fires vary of course, but they do occur from April through October.

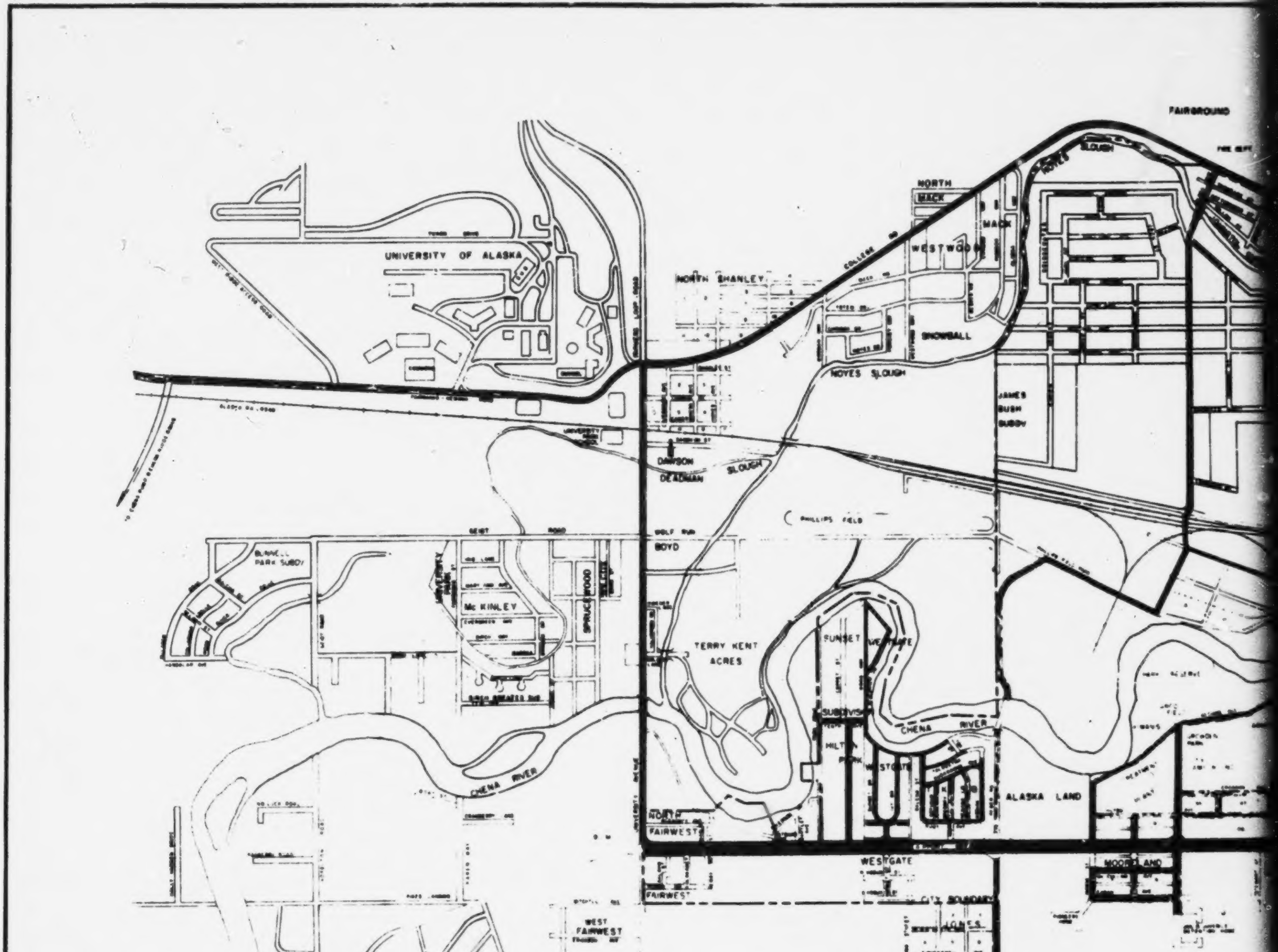
Open burning for land clearing operations is yet another source, perhaps a major source, of particulate emissions during the summer season. Current regulations in the North Star Borough permit the clearing of small land parcels (1/2 acre) by open burning. Permits are required for larger fires. Judging by the large number of fire reports in the files of the Bureau of Land Management, the number of large man-made fires reported in the area are probably associated with land clearing operations initially intended to be limited in size.

3.4.1.3 Traffic and Road Sources

Most of the streets in the CBD are paved as are the main access roads. However, Figure 3-3 shows that the streets of the residential section northeast and south of the CBD are unpaved. Traffic in the CBD is high, especially so in the summer as shown in Figure 3-4 The access roads, which carry a great flow of traffic as shown on Figure 3-5 have soft shoulders. In dry weather, the road surface outside the normal car car tracks is dusty so that cars cutting across lanes to pass or pulling over onto the road shoulder raise a great deal of dust and the higher their speed, the thicker the dust cloud.

In wet weather the dust is transformed into mud and transported onto the city streets. Construction sites, street repairs and underground utility installations are sources of tracked-in mud.

Projected improvements in traffic flow, resulting in accelerated car flow may further aggravate the dust problem, unless steps are taken to cope with it.


FAIRGROUND
FIRE DEPT
NOYES SLOUGH
NORTH
MACK
MACK
WESTWOOD
COLLEGE RD
UNIVERSITY OF ALASKA
NORTH SHANLEY
SNOWBALL
NOYES SLOUGH
JAMES
BUSH
SUBDV
UNIVERSITY
DAWSON
DEADMAN SLOUGH
PHILLIPS FIELD
GEIST ROAD
WOLF RUN
BOYD
BUNNELL
PARK SUBDV
McKINLEY
SPRUCEWOOD
TERRY KENT
ACRES
SUNSET
WESTGATE
SUBDIVISION
HILTON
PARK
WESTGATE
CHENA RIVER
CHENA RIVER
ALASKA LAND
NORTH
FAIRWEST
WESTGATE
FAIRWEST
CITY BOUNDARY
WEST
FAIRWEST
JONES
SUBDIVISION
MOORELAND
SCHOOL SECTION
INTERNATIONAL AIRPORT

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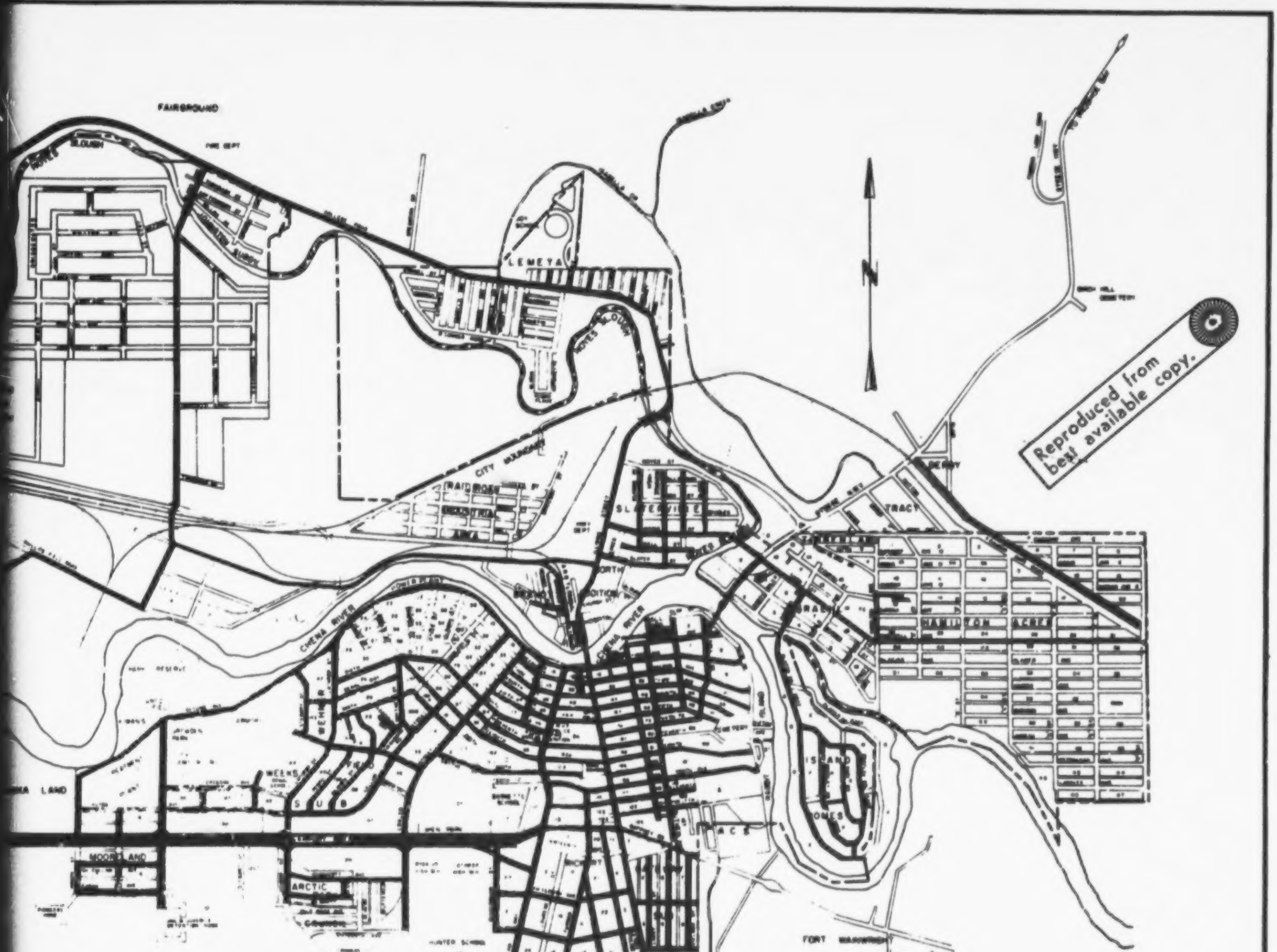
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FIRE DEPT
LEMETA
CITY BOUNDARY
INDUSTRIAL AREA
SLATERVILLE
TRACT
HAMILTON ACRES
GRAEHL
CHENA RIVER
ISLAND HOMES
WEEKS SUB
MOORELAND
ARCTIC
FORT WAINWRIGHT
HUNTER SCHOOL
SCHOOL SECTION
BJERREMARK
SUBDIVISION
SOUTH FAIRBANKS
CUSHMAN
▬ HOT MIX PAVING
▭ OIL & CHIP PAVING
CITY OF FAIRBANKS, ALASKA
OFFICE OF CITY ENGINEER
CITY OF FAIRBANKS & VICINITY

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Figure 3-3. Paved and Unpaved Streets in Fairbanks

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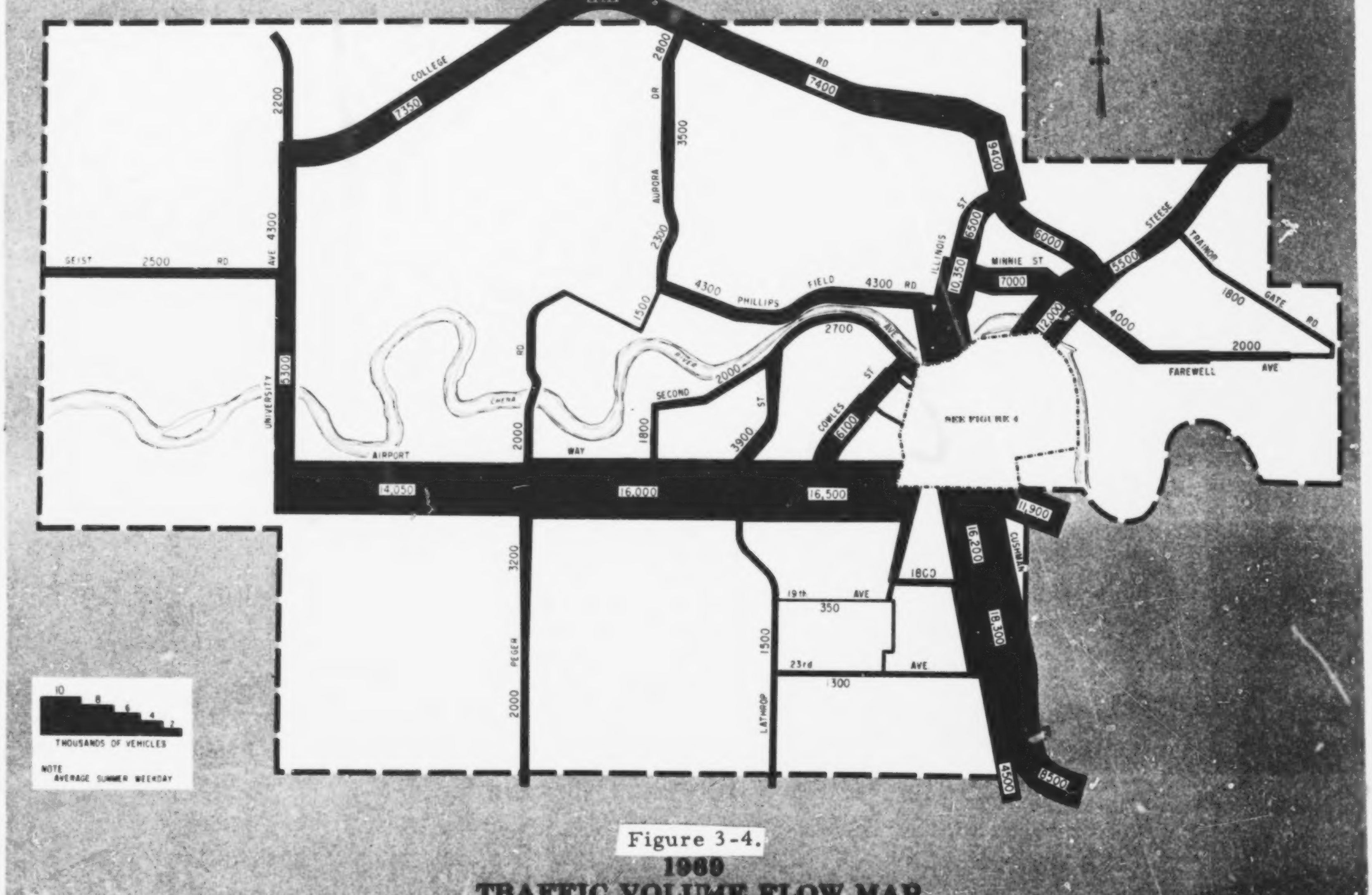
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LATHROP
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PEGER
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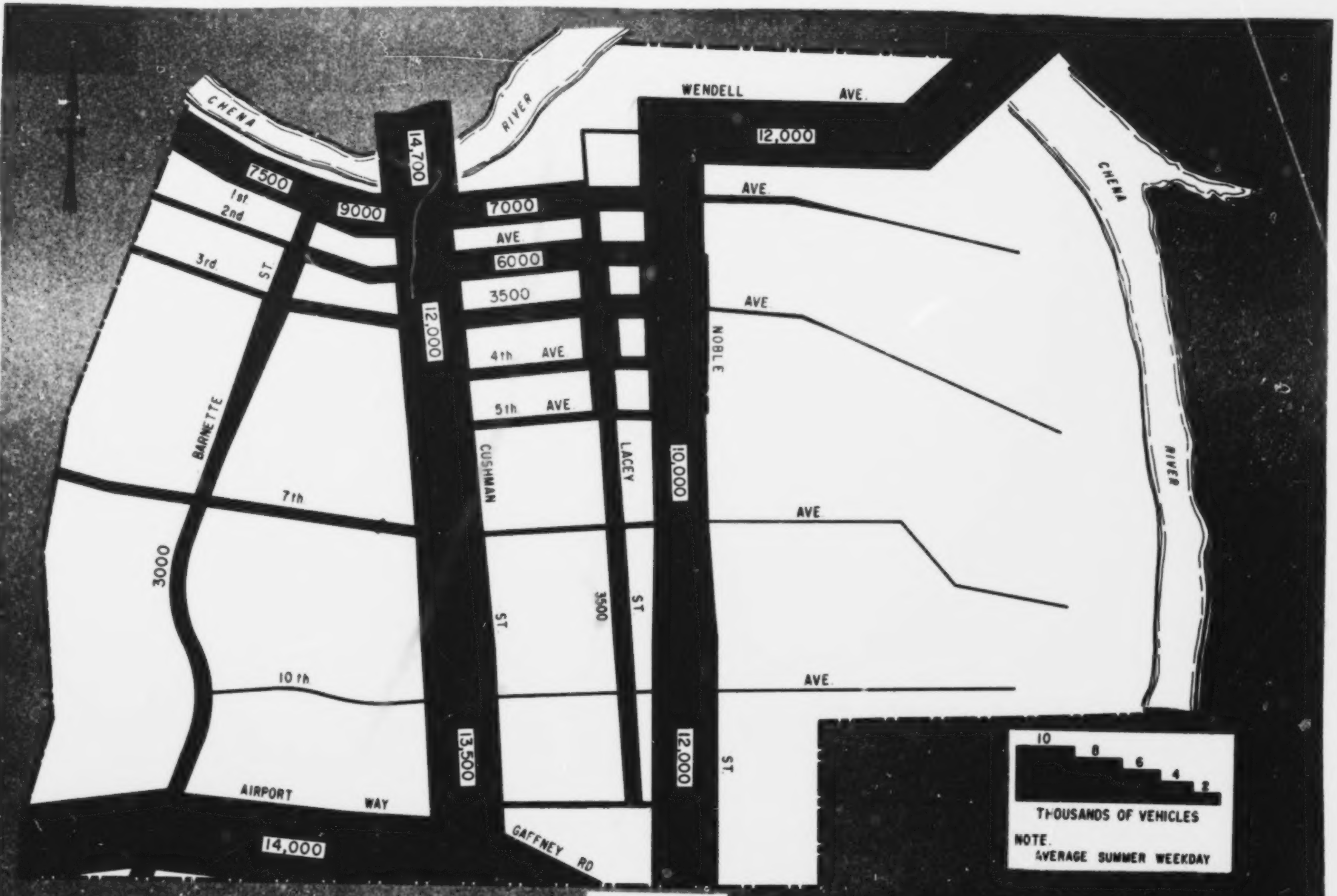
8
6
4
2
THOUSANDS OF VEHICLES
NOTE
AVERAGE SUMMER WEEKDAY

Figure 3-4.
1969
TRAFFIC VOLUME FLOW MAP
TOPICS STUDY ROUTES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THOUSANDS OF VEHICLES
NOTE.
AVERAGE SUMMER WEEKDAY

Figure 3-5.

[illegible]

TRAFFIC VOLUME FLOW MAP

[illegible]

The streets in the Fairbanks CBD are cleaned every night during the warm season, when the temperature is not so low as to freeze the water in the sweepers. A wetting agent is added to the water to increase its cleansing action. Residential sections in which the streets are paved are cleaned on a rather irregular schedule (which is influenced by complaints).

In winter 3/8-inch chips are used on the icy streets and roads. These chips are quartz rock cubes and do not disintegrate under the car wheels. Oiling of unpaved roads starts after the thaw. Good quality highly wetting oil is used. The schedule is not regular as road grading is also necessary.

3.4.2 Carbon Monoxide

Carbon monixide emissions for Fairbanks are 35,182 tons/year (Reference20, page 10). Of this total 23,323 tons/year are from gasoline motor vehicles and 2,253 tons/year from diesel motor vehicles. The remaining 10,000 are fairly evenly divided between other sources. Point source contribution is very small.

3.5 IMPACT OF EMISSIONS ON AIR QUALITY

The Area Model Estimation procedure (Reference 6) was used to convert the emission rates into air quality — as was done for the Cook Inlet Region (Section 2.5). The estimation of air quality is highly dependent on the choice of "urban area" on which the estimation is based. Two reasonable choices were made and air quality calculations were made for both (see Appendix 3B). These urban areas are the following:

1) Area of a rectangle enclosing the city of Fairbanks: 42 km^2

2) Area of an "air shed" (Figure 3-6) bounded on the north and northeast by the rdiges of hills, on the west by Happy Creek and Chena River, on the south by the Tanana River and on the east by a north-south line selected to include Fort Wainwright, 227 km^2.

A typical average wind velocity for this area of 2.3 m/sec was used (Reference 3).

3.5.1 Particulate Matter

Particulate concentration from man-made emission sources exclusive of traffic-generated dust were

$$\chi = 116\ \mu g/m^3 \text{ on the basis of } 42\ km^2$$

and

$$\chi = 59\ \mu g/m^3 \text{ on the basis of the } 227\ km^2 \text{ area.}$$

These particulate concentrations are close to monthly geometric mean concentration values measured during the winter months, 75 to 120 $\mu g/m^3$, shown on Figures 3A-1 through 3A-5.

Figure 3A-5 shows the 4-year average of the monthly geometric means (1967-1970). The primary NAAQS concentrations of 75 $\mu g/m^3$ are exceeded even in the winter months and soar above 400 $\mu g/m^3$ in September.

3.5.2 Carbon Monoxide

Carbon monoxide 8-hour average concentrations were calculated using the area model for city areas of 42 km^2 and 227 km^2 (Appendix 3B). These areas correspond to the City of Fairbanks and the larger "air shed" area, respectively. The concentrations were found to be

$$\chi = 4.2\ mg/m^3 \quad (42\ km^2)$$

$$\chi = 1.6\ mg/m^3 \quad (227\ km^2)$$

for an average wind speed of 2.3 m/sec. Measured values much higher, 81 mg/m^3, have been observed by NASN. This calculation clearly shows that the emission sources considered do not account for the carbon monoxide problem.

A review of stationary sources showed that the very stable inversion layer is so low that stacks protrude through the ceiling. Therefore, emissions from these sources do not return to ground level, at least not in Fairbanks.

A review of mobile sources, primarily automobiles, showed several interesting facts. Because of the low ambient temperature, shoppers habitually leave their automobiles running while they are in the stores. Further, workers start and run their automobiles several times daily for about one-half hour so that they will start easily.

This continual running of automobiles results in very large quantities of carbon monoxide being released. Then, because of the low inversion, it is trapped in the city. The calculations of Appendix 2C show that 24% of the carbon monoxide generated by automobiles (on a yearly average) is produced during idle. Automobiles are the primary source contributing to the high carbon monoxide levels.

Other potential sources of carbon monoxide were reviewed to check on the conclusions of the previous paragraph. Eielson AFB contributed essentially no carbon monoxide to downtown Fairbanks. The inventory showed that mobile sources contributed 71% or more of the total CO to the downtown area. The other 25% is fairly evenly distributed among six other contributors.

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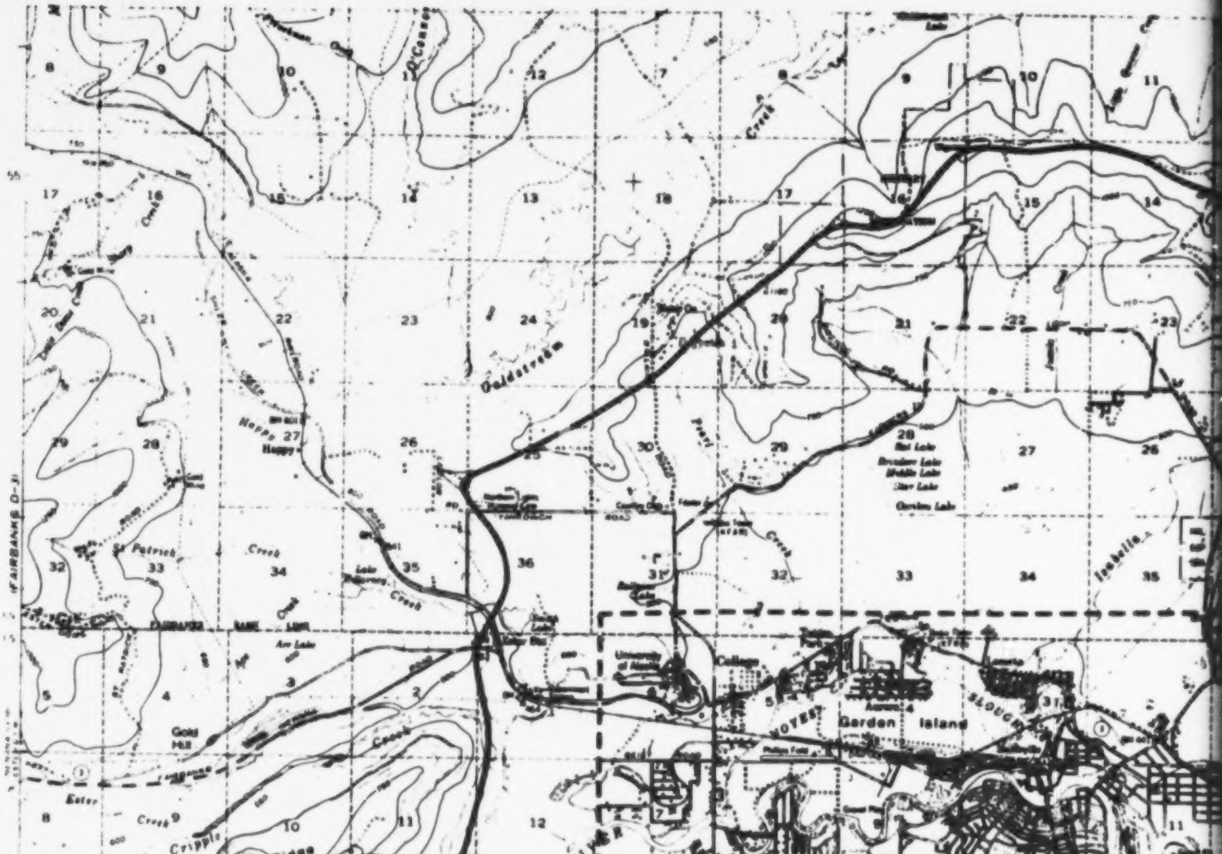
Goldstream
Happy
St. Patrick
Creek
Isabella
Gold Hill
Ester
Cripple
Ridge
Chena
College
Garden Island
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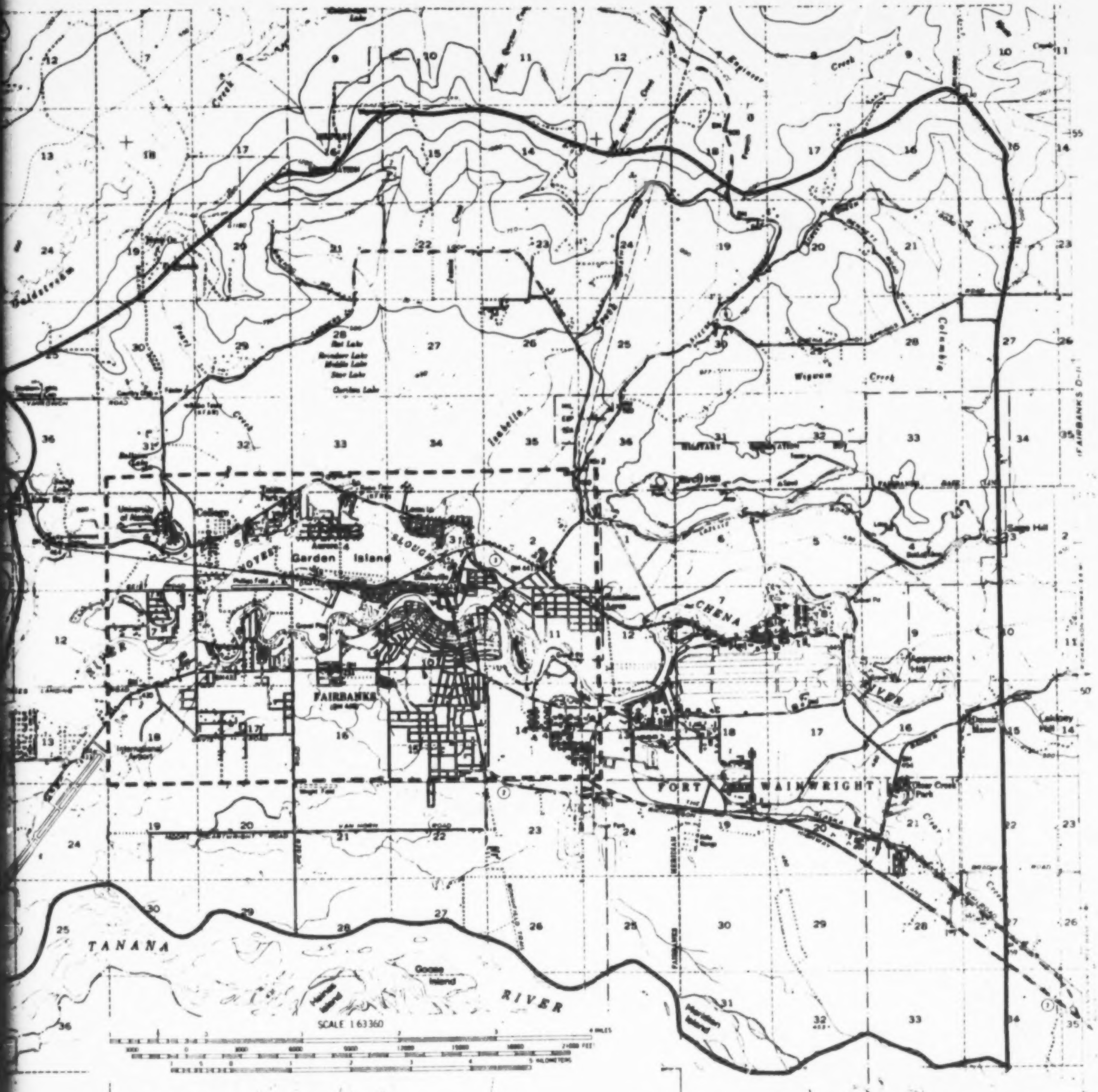
TANANA
RIVER
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RIVER
FAIRBANKS
Garden Island
FORT WAINWRIGHT
Goose Island
College
Isabella
Wigwam Creek
Columbia
Engineer Creek
Goldstream
SCALE 1:63360
B L A I R   L A K E

Figure 3-6. Fairbanks "Urban Area" and "Air-shed Area"

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3.6 PROPOSED CONTROL STRATEGY

3.6.1 Particulate Matter

The reasonably available control technology can reduce the 1970 emissions listed in Table 3-4 to approximately 3470 tons per year, or a reduction of 47%. This technology corresponds to 0.3 lb/million Btu for coal burning power plants and 0.2 lb/100 lb of refuse for incinerators. These figures represent the suggested control requirements of the Environmental Protection Agency and are delineated in Reference 6, Appendix B. The requirements of the proposed Rules and Regulations of the State of Alaska reflect even more stringent abatement to facilitate the attainment of the secondary NAAQS. This requirement imposes a limitation of 0.1 grain/scf which corresponds to about 0.2 lb/million Btu. Appendix 3-B shows this reduction will increase chances of the attainment of the secondary national air quality standards and still allow for a considerable contribution from other sources such as roads and forest fires. This stringent requirement is justified on the basis that considerable contributions exist from road dust and forest fires. The former is much more expensive to control while the latter is not controllable at all in the conventional sense. The State regulations will require particulate emission control of coal fired boilers of about 97%, assuming typical uncontrolled emission rates of 7.4 lbs/million Btu.

A special study is proposed in the Air Quality Surveillance Volume which will provide direct evidence as to the effectiveness of the control of major coal fired installations in Fairbanks. The results of this study, which will be available in July 1973, will be used to validate the control specifications for these sources.

Prohibition of open burning and regulation of incineration are also recommended control measures. These potentially, will reduce the total particulate emissions in Fairbanks by 5300 tons per year.

Quantification of the impact of road paving, oiling and street and road sweeping is not possible at this time (see the discussion on the Anchorage area). However, it is known that dust is generated by traffic on gravel roads and on paved roads and streets covered with tracked-in dust. The following improvement schedule is proposed to be implemented in parallel with a data gathering and evaluation effort, and modified in accordance with the findings of that effort.

Phase I. 1972

1) Paving Southwestern and Southern Residential Sections. In summer, the prevailing winds are from the southwest, so that dust from the Jones and the Bjerremark Subdivision is most likely to be blown into town, where the particulate concentrations are highest.

   Implementation of this strategy will be accomplished by negotiating with City and Borough officials to insure that air pollution priorities are included in the normal road improvement schedule.

2) Increase Street Sweeping. Increased operation of existing street sweeping units will be undertaken with the daily cleaning carried out on the central section of the city extended to the heavily travelled streets designated for soft shoulder oiling.

3) Oil Soft Shoulders. A program will be initiated to apply oil to the unpaved shoulders of 11 miles of arterial road way.

   The following roads are designated for oiling (4 times during the period May through September) and daily street sweeping: Airport Way, University Avenue, College Road, Illinois Street, and South Cushman Street.

Phase II. 1973

Air quality monitoring data and the results of special studies will be reviewed to determine the exact magnitude of the suspended particulate problem and the effectiveness of the control measures taken. Additional reduction of emission levels may be required at this time.

If heavily travelled paved roads and streets are found to be large contributors of suspended particulate, further increases of street cleaning fequency and extension to more streets will be necessary. If unpaved roads and streets are found to be responsible for much of the particulate concentrations.

- o An extension of the paving program must be implemented
- o Increased oiling of gravel roads and of oiling of unpaved shoulders on hard surface roads initiated.

Control of construction and land clearing operation to reduce blown dust and tracked-in mud will also be considered.

The above strategy describes specific initial steps to be used in reducing suspended particulate levels in the Fairbanks North Star Borough.

Review of air quality and emissions data are essential steps in the definition and implementation of strategy to achieve primary particulate standards by 1975.

3.6.2 Carbon Monoxide

Maximum concentrations of carbon monoxide are found in the central business district of Fairbanks under sharp temperature inversions, low wind speed and low ambient temperatures. The maximum one hour concentration measured of 81 mg/m^3 and a one month average of 1 .8 mg/m^3 have been recorded. This data is limited having been taken at only one site. Therefore the spatial expanse of these high concentrations is not known. Evenso, the data does show a serious problem. A roll back calculation indicates that 50% (80 to 40 mg/m^3) reduction is required.

3.6.2.1 Federal Motor Vehicles Program

Moble sources are the major contributor of carbon monoxide to Fairbanks. The Federal Motor Vehicles Program will reduce the emissions rates from these sources. A reduction of 27% is expected by 1975 and 45% by 1977 (Reference 7, Appendix I). These figures apply to the average driver in the continental United States where the climate is relatively moderate. Adjustments to these expected reductions are required to account for the severe winter driving conditions occurring in Fairbanks. A 35% reduction in emissions by 1977 is a more realistic figure for the Fairbanks area.

3.6.2.2 Summary of Control Measures Considered

Extensive study was conducted to determine potential solutions to the carbon oxide problem and many alternatives were evaluated. A summary of the alternatives studied and rejected is given in Appendix 3C. Recommended control measures are described in the following section.

3.6.2.3 Recommended Control Measures

Plug - Ins - Installation of additional plug-in facilities was one of the measures retained to be implemented. A plug-in is an electric outlet (110 volts) located in the proximity of a parking space for automobiles. It permits the car owner to operate headbolt and circulation heaters installed in the engine compartment. The heaters, having 1 to 2 kw rating, keep the engine warm for subsequent operation. Some cars may have a heating plate under the battery and a space heater in the car interior. The use of these plug-in facilities, therefore, would permit quick startup in below zero weather without the necessity of extended idling times. The advantages of plug-ins are their almost total elimination of carbon monoxide emissions from idling, they are relatively inexpensive, they could potentially pay for themselves, and they represent a savings to motorist. The disadvantages are that they are effective only in cold weather, they are difficult to install in existing parking areas and they require an extensive electrical distribution system.

Parking spaces with plug-ins are rented by the month at a premium. The normal rental fee is $20 per month on an annual basis. The demand currently exceeds the supply for persons employed in the center city. There are approximately 500 plug-in parking spaces today in use by persons employed in the Center city, at high schools and at the airport. No parking spaces are currently available for shoppers. It is estimated that about one hour of idling is eliminated by the availability of plug-in parking spaces per person employed in the center city area.

Staggered Work Shifts - Staggering the work shifts for the downtown area has the advantages that it is a very effective measure in reducing hourly peak concentrations, however, it may not effect longer term averages. It smooths out traffic flow and reduces rush hour traffic concentrations. A problem is that the exact effects on air quality of staggered work shifts are not known.

Elimination of On-Street Parking - The advantages of eliminating street parking is that it provides for an additional lane of traffic which improves traffic flow - thus reducing emissions; eliminates excessive circling of the block when shoppers look for on-street parking spaces, which reduces emissions. However, alternative off-street parking has to be provided in order to make this measure acceptable to downtown merchants.

Bypass Roadways - The advantages of bypass roadways are that it eliminates many motor vehicle trips that would otherwise go through downtown Fairbanks. The traffic diverted by the bypass would reduce traffic volume through downtown and thus improve traffic flow.

A bypass roadway is to be constructed in 1972 - 1973. It is called Project F-061-1(6) Gaffney Road to Farmers Loop. It runs from Gaffney Road (southern section of town) across the river and ties into the Steese Highway (northeast section of town). This path can be traced on the map of Fairbanks, Figure 3-6.

Bus System - The use of an extensive, permanent bus system for Fairbanks including a terminal facility and waiting stations has been considered but rejected because of high cost and the anticipated low public acceptance. However, if the other strategies considered and proposed in this plan do not result in the projected reduction of carbon monoxide emissions, a bus system may have to be reconsidered as a measure in spite of cost or public acceptance. Though waiting for a bus in extreme cold is not conducive to public acceptance of a bus system, a system operated on a tight schedule may gain public support. Such a system may receive additional reinforcement if one considers the expense of running a car in the winter time in the Fairbanks area.

Improved Traffic Flow. Carbon monoxide concentrations can also be somewhat reduced by speeding up traffic flow. Carbon monoxide emissions increase with reduced speed as well as with idling in traffic. Traffic flow can be enhanced by increasing speed limits, or by use of flexible traffic control, such as SAFER, in which traffic signals are operated as a function of car density.

3.6.2.4 Recommended Strategy

1972	Prohibit any idling of an unattended automobile, effective September 1972 Require that all new parking spaces be equipped with plug-in facilities Require that 75% of all existing parking spaces be equipped with plug-in facilities by 1975. A plan of the implementation shall be submitted from the Borough to the Department of Environmental Conservation by June 1972.
1972-73	Conduct studies to determine the effect of the following on CO concentrations: 1) staggered work shift; 2) elimination of on-street parking; 3) traffic volume; 4) stationary source emissions
1973	The Gaffney Road to Farmers Loop bypass roadway will be completed
1974	Continue any studies mentioned above if determined necessary
1975	75% of all existing parking spaces will be equipped with plug-in facilities Elimination of on-street parking will be implemented if determined necessary by the results of the special study in 1972.

Expected Emission Reduction from Proposed Control Strategy. As calculated in Appendix 3C, 76% of CO emissions are attributable to driving and 24% are attributable to idling.

A 45% reduction of emissions from driving can be expected by 1977 from the Federal Motor Vehicle Program under normal operating conditions. Since control of 1975 and later model year vehicles will rely heavily on "no-choke" driving conditions, a 45% reduction may be too optomistic for Fairbanks winter driving. Assume a 35% reduction from the Federal Motor Vehicle Program to be more realistic for the driving portion of CO emissions in Fairbanks.

The idling portion of CO emissions in Fairbanks will be controlled by the limit on idling as well as the plug-in facilities. The regulations will provide for a 63% reduction in excessive idling emissions by 1975 (Reference 7, Appendix C).

Combining these percentages, the following total reduction may be realized:

Driving: 35% expected reduction in 1977
weighted 76% for driving = 26.6%

Idling: 63% expected reduction in 1975
weighted 24% for idling = 15.2%

Total Expected
Reduction in Carbon
Monoxide Emissions: 26.6 + 15.2 = 41.8

The bypass roadway is assumed to provide an additional 10%, therefore, the required 50% reduction will be achieved by 1977.

4. THE SOUTH CENTRAL ALASKA INTRASTATE AIR QUALITY CONTROL REGION

4.1 REGION DESCRIPTION

The South Central Alaska Intrastate Air Quality Control Region constitutes those portions of the 1956 Election Districts 7-17, inclusive, and Election District 24 described in Article XIV, section 3 of the Constitution of the State of Alaska, which are not included in the designated Cook Inlet Intrastate Air Quality Control Region as designated August 12, 1970.

This region encompasses a portion of Western Alaska, Southwest Alaska (the Aleutians) and South Central Alaska. (Figure 4-1).

The region is sparsely populated with approximately 37,000 persons. The major economic activities in this part of Alaska relate primarily to the fishing industry. In addition, there are numerous military installations on Kodiak Island and the Aleutian Island chain.

4.2 PRESENT AIR QUALITY

There are currently no air quality data in existance for evaluation in connection with this study. Air quality measuring instrumentation recommended for installation in this region is defined in the Air Quality Surveillance Volume of this Implementation Plan.

4.3 EXISTING SOURCES OF AIR POLLUTANTS

A summary of the major emission sources of particulate matter, SOX and carbon monoxide (in excess of 100 tons per year) identified in the emission inventory are listed in Table 4-1. Roads are not extensive; as a result, motor vehicle traffic is not a significant contributor to air pollution. Approximately 41 million vehicle miles are travelled in the region per year by approximately 5800 registered vehicles. With the exception of King Salmon Airport and

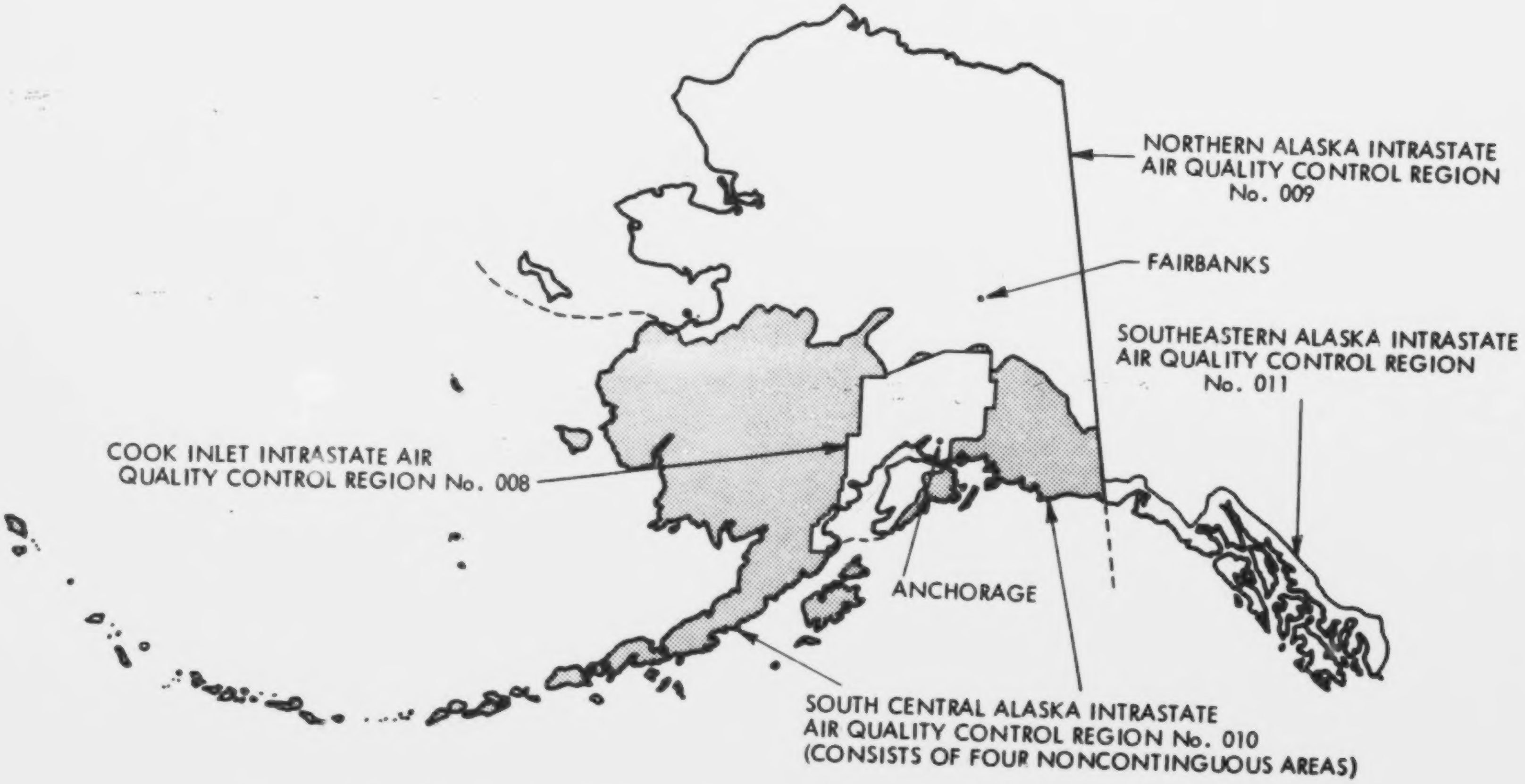
NORTHERN ALASKA INTRASTATE
AIR QUALITY CONTROL REGION
No. 009
FAIRBANKS
SOUTHEASTERN ALASKA INTRASTATE
AIR QUALITY CONTROL REGION
No. 011
COOK INLET INTRASTATE AIR
QUALITY CONTROL REGION No. 008
ANCHORAGE
SOUTH CENTRAL ALASKA INTRASTATE
AIR QUALITY CONTROL REGION No. 010
(CONSISTS OF FOUR NONCONTINGUOUS AREAS)

Figure 4-1. Air Quality Regions of Alaska—South Central Alaska Air Quality Control Region No. 010

Table 4-1. Major Emission Sources (>100 Tons/Year)
Region 010 - South Central Alaska Intrastate

Pollutant	Source No. (Inventory)	Source Name	Political Jurisdiction	Emissions (Tons/Year) (Uncontrolled)
Particulate	24	Naval Station-Kodiak	5	200
SO_2	22	Naval Station-Kodiak	5	1880
CO	11	King Salmon Airport	3	350
	15	Kodiak Electric	5	384
	19	Naval Command Station-Adak	1	153
	20	Naval Command Station-Adak	1	680
	24	Naval Station-Kodiak	5	1058
	28	Shemya AFB	1	488
	30	Shemya AFB	1	122

Kodiak Electric, all major sources are federal facilities, many of which have diesel generators. The largest single source, the Kodiak Naval Station, accounts for emissions as high as 1880 tons of SO_2 from its power plant burning oil having a sulfur content up to 3.5%. It also burns solid waste in the amount of 24,900 tons/year. In light of calculations performed in Appendix D-1 for sources of similar magnitude none of these emissions appear to sufficient to result in violation of the secondary national air quality standards. The compliance of these facilities with the proposed Rules and Regulations for Air Quality for the State of Alaska is expected to necessitate the use of fuel oil not exceeding sulfur content of about 1%, resulting in a 70% reduction of SOX emissions at the Kodiak Naval Station.

4.4 POTENTIAL NEW SOURCES

In addition to several pumping stations (see Section 3.3.2 for typical emissions) along the north-south pipeline route in this Region, the terminal for crude oil transport will be located at Valdez. Air pollutants will be emitted at the terminal from fuel burning equipment and storage. The estimated fuel burning equipment emissions, from diesel engines, fired heaters and incinerators are as follows (Reference 7)

Particulates	23 tons/year
Sulfur Dioxide	572 tons/year
Carbon Monoxide	2650 tons/year
Nitrogen Oxides	1,190 tons/year
Hydrocarbons	84 tons/year

Hydrocarbon emissions are to be minimized by equipping oil storage tanks with vapor recovery systems as required by the proposed regulation for Alaska.

A copper ore processing operation is projected for the McCarthy area of this air quality region. It is estimated that approximately 5,000,000 tons of ore per year will be processed if the undertaking materializes. The air emissions of such an operation depend on the processes used, the abatement equipment installed and its efficiency. The estimated characteristics of this source are summarized in Table 4-2. The minimum controlled emission indicated represents the application of reasonably available control technology while the maximum emissions represent the use of low efficiency abatement equipment. As plans for this installation become formalized the State of Alaska will, through the Permit System, collect data necessary for a comprehensive evaluation of the impact of these sources on air quality.

4.5 PROPOSED CONTROL STRATEGY

No specific control measures are required for this AQCR since there are no adverse air quality measurements or estimations.

Enforcement of statewide air pollution regulation and implementation of the permit system in which a comprehensive review of all new source construction is made will provide for the maintence of ambient pollution levels below the secondary NAAQS. The ambient air quality surveillance system, proposed in this Plan, will allow detection of air quality deterioration and provide the baseline data upon which to plan industrial and population growth in the region.

Table 4-2. Potential New Source

	Air Quality Region 010
Type of Operation	Copper Ore processing crushing and milling only
Firm Name	International Nuclear Exploration Company INEXCO
Probable Location	McCarthy area
Probable Process Rate	Unknown - Probably 5,000,000 ton/year
Potential Emissions (Uncontrolled)	
Particulate Matter	~11 lb/ton of ore (Table 88 of the Emission Factors Handbook)
Potential Emissions (Reasonably available control technology)	~47 lb/hr 205 ton/year

5. THE SOUTHEASTERN ALASKA INTRASTATE AIR QUALITY CONTROL REGION

5.1 REGION DESCRIPTION

The Southeastern Alaska Intrastate Air Quality Control Region includes those portions of the 1956 Election Districts 1-6, inclusive, as described in Article XIV, section 3 of the Constitution of the State of Alaska. The boundaries of the region are shown on Figure 5-1.

The southeastern region consists of several major islands, thousands of smaller islands, and a thin strip of mainland bounded on one side by Canada and on the other by the Pacific Ocean. This land area of approximately 30,000 square miles is similar in size to the state of Maine. Ferries of the Alaska Marine Highway System serve to interconnect the major cities of the area. The only other modes of intercity transportation involve scheduled airlines and small amphibious aircraft.

The population is engaged primarily in fishing, lumbering, pulp manufacturing, and tourism. The bulk of Alaska's pulp and lumber activities are in this area; forests of spruce and hemlock cover most of the islands.

5.2 PRESENT AIR QUALITY

There are no air quality data in existence for evaluation in connection with this study. Air quality measuring instrumentation recommended for installation in this region is outlined in the Air Quality Surveillance Volume of this Implementation Plan.

5.3 EXISTING SOURCES OF AIR POLLUTION

Major economic activity in this part of Alaska relates to industries dependent on lumber. Two major pulp mills utilizing the sulfite process are currently in operation. One of the mills, the Ketchikan Pulp Company, is located at Ward Cove near the town of Ketchikan and the other, Alaskan Pulp and Lumber, is located at Sitka. These two mills are separated by

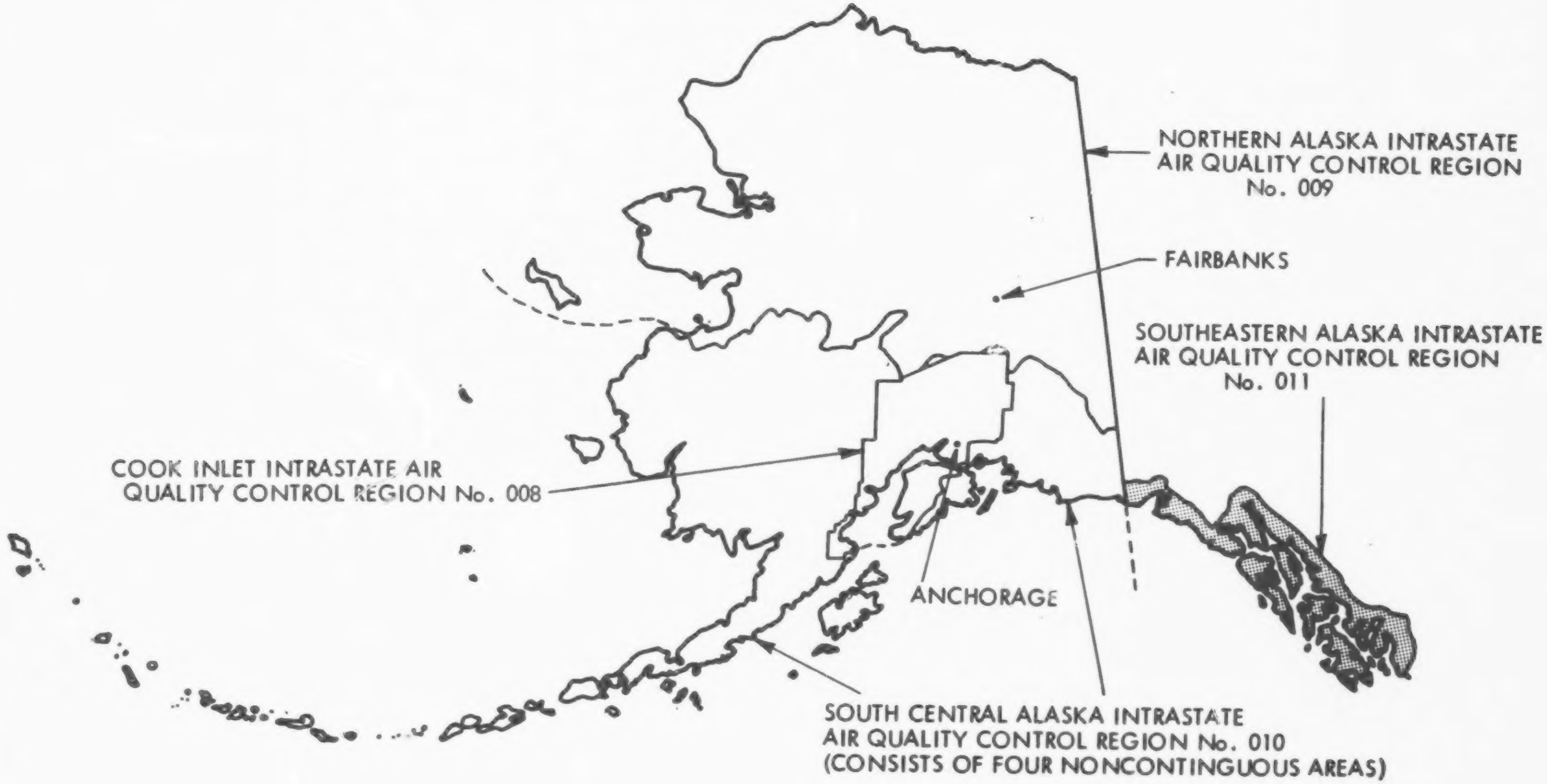
NORTHERN ALASKA INTRASTATE AIR QUALITY CONTROL REGION No. 009
FAIRBANKS
SOUTHEASTERN ALASKA INTRASTATE AIR QUALITY CONTROL REGION No. 011
COOK INLET INTRASTATE AIR QUALITY CONTROL REGION No. 008
ANCHORAGE
SOUTH CENTRAL ALASKA INTRASTATE AIR QUALITY CONTROL REGION No. 010 (CONSISTS OF FOUR NONCONTINGUOUS AREAS)

Figure 5-1. Air Quality Regions of Alaska — Southeastern Alaska Air Quality Region No. 011

200 miles. Considerable SOX emissions occur from these mills as a result of process venting and the burning of Bunker C fuel oil (average sulfur content 1.3%). Particulate matter is also emitted as part of the liquor incineration process.

Several lumber companies also operate in this region; among these are Alaska Wood Products, Wrangell Lumber and Alaska Price Timber. Lumber companies of this type dispose of major quantities of wood waste through the use of large conical burners typically 40 feet in diameter and 60 feet in height. Wood waste is also used as boiler fuel to some extent. As a result, these lumber companies are sources of particulate and carbon monoxide emissions.

A summary of typical emission rates for the significantly large sources are indicated in Table 5-1. The SOX emissions of the boilers at Alaskan Lumber and Pulp are unknown and assumed to be the same magnitude as that for Ketchikan Pulp because the plants produce the same amount of product.

There are approximately 14,700 registered motor vehicles in this region. There are no major highways and very few roads, and the average vehicle travels about 5250 miles per year.

Calculations were performed to establish whether ground-level concentrations of SOX and CO, and as appropriate, particulates, would exceed the primary and secondary material air quality standards at locations downwind from the major sources in the Region. The details of these calculations are presented in Appendix 5A. A summary of results is presented in Table 5-2.

Table 5-1. Major Stationary Point Source Emissions - Southeastern Alaska

	Actual Emissions, Tons/Year				Allowable, Tons/Year	
Name	Type of Source	SOX	Parti-culates	CO	SOX	Parti-culates
Alaska Lumber & Pulp	Sulfite Mill	1600	1000*		2260	
Ketchikan Pulp	Sulfite Mill	3400	2000*		2260	
	Boiler (two stacks)	2820*	320*		2170	
Alaskan Wood Products	Conical Burner		107	1988		
Wrangell Lumber	Conical Burner		253*	4693*		

*Represents a revision of the Emission Inventory dated August 1971.

Table 5-2. Maximum Downstream Concentrations for Major Point Sources, SOX, CO, and Particulates (Stability Class D -- 1m/sec Wind Velocity)

Name	Estimated Maximum Downstream Concentration			National Air Quality Standards		
	SOX, $\mu g/m^3$ (max 24 hour)	CO, mg/m^3 (1 hour)	Particulates, $\mu g/m^3$ (max 24 hour)	SOX, $\mu g/m^3$ (max 24 hour)	CO, mg/m^3	Particulates $\mu g/m^3$ (max 24 hour)
				PRIMARY STANDARD:		
Alaska Lumber & Pulp (Process)*	130 $\mu g/m^3$		34 $\mu g/m^3$	365 $\mu g/m^3$	35 mg/m^3 1 hour max	260 $\mu g/m^3$
				SECONDARY STANDARD:		
Ketchikan Pulp			78	260	10 8 hour max	150
(Process)*	250					
(Boiler)	51					
Total	301					
Alaskan Wood Products (Conical Burner)		0.5 mg/m^3	0.8			
Wrangell Lumber (Conical Burner)		0.1	1.8			

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[*] The uncontrolled emission rates for Alaska Lumber & Pulp and Ketchikan Pulp were assumed equal because the plants produce the same amount of pulp.

5.4 POTENTIAL NEW SOURCES

There are three industrial operations currently projected for this region. These consist of a pulp mill and two ore processing facilities. The available details of these are summarized in Tables 5-3, 5-4, and 5-5 showing potential emissions using reasonably available control technology.

Although particulates represent the major air pollutant emissions from the ore processing facilities, the possibility of other air contaminants, especially fluorides, from the pelletizing and processing operations must not be overlooked. As plans for these installations become more definite the State of Alasks will, through the Permit System, collect data necessary for a comprehensive evaluation of the impact on these sources on air quality.

5.5 PROPOSED CONTROL STRATEGY

The emission reduction requirements which appear to be evident in Table 5-2 are those relating to meeting the secondary national air quality standards for SOX emissions from the pulp mills. In the case of Ketchikan Pulp, pollution concentrations due to process emissions approach the secondary standard within the accuracy of the calculations. When SOX outputs from fuel burning are combined with the process emissions (all emissions occur in close proximity), the secondary standard is exceeded by a considerable margin. Alaska Lumber and Pulp indicates SOX process emissions roughly half of that of Ketchikan Pulp, even though their process rate is about the same. The reason is that the former is currently not using all of its liquor. With the new water pollution regulations in force, these lower emissions may only be temporary.

The process rate for both pulp mills is about 620 tons of dried pulp per day. SOX emissions were assumed to correspond to emission rates of about 30 pounds per ton of dried pulp based upon EPA factors. Reasonable available control technology permits a reduction of such emissions to 20 pounds per dried ton (Reference 27), a reduction of 33%. This attainable reduction is reflected in Table 5-6 for

Table 5-3. Potential New Source

	Air Quality Region 011
Type of Operation	**Pulp Mill**
Firm Name	**U.S. Plywood**
Probable Location	**Berner's Bay — 42 miles north of Juneau**
Probable Process Rate	**600-750 tons/day of dried pulp, process unknown**
Potential Emissions (Reasonably Available Control Technology)	
SOX	9 lb/ton of dried pulp 990-1220 tons/year
Particulates	26.4-30.5 lb/hour 116-134 tons/year

Table 5-4. Potential New Source

	Air Quality Region 011
Type of Operation	Tin, berrylium, fluoride ore processing and pelletizing
Firm Name	Snettisham Iron Ore Marcona Company
Probable Location	30 miles south of Juneau
Probable Process Rate	5,000,000 tons/year of ore processed
Potential Emissions (Uncontrolled)	
Particulates	~11 lb/ton of ore (Table 88 of the Air Pollutant Emission Factors Handbook)
Potential Emissions (Reasonably Available Control Technology)	~47 lb/hour ~205 tons/year

Table 5-5. Potential New Source

	Air Quality Region 011
Type of Operation	Iron ore pelletizing plant
Firm Name	Mitsutitchi Company
Probable Location	Klukwan — 90 miles north of Juneau
Probable Process Rate	5,000,000 tons/year of iron ore
Potential Emissions (Uncontrolled)	
Particulate	~11 lb/ton of ore dry process (Table 88 of the Air Pollutant Emission Handbook)
Potential Emissions (Reasonably Available Control Technology)	~47 lb/hour ~205 tons/year

Ketchikan Pulp. Additionally, to meet the requirements of the proposed Rules and Regulations for Air Quality Control of the State of Alaska, an emission rate of 500 ppm of SOX which corresponds to the use of fuel oil will be limited to about a 1% sulfur content (Section 7, Appendix D-1). The net result of these reductions, indicated in Table 5-6, will provide for the attainment of the secondary standards. The attainment of these reductions is projected for January 1975, in accordance with the Compliance Schedule Volume.

The atmospheric diffusion estimates shown in Table 5-6 represent the maximum expected downwind groundlevel concentrations based on a local wind speed of 1 m/sec and a Class D Stability category. This stability category is characterized by limited horizontal and vertical mixing and occurs frequently at night or under conditions of heavy overcast. This estimate is believed to be a representative maximum for ground level concentrations in this part of Alaska.

Table 5-6. SOX Rollback Requirements for Sulfite Pulp Mill (Ketchikan Pulp) (Class D Stability, 1 m/sec Wind Velocity)

Source	Estimated Current SOX Emission Factor	Currently Available Technology	Maximum 24 Hr Estimated Current Air Quality	Maximum 24 Hr Projected Air Quality	National Air Quality Standards
Pulp Mill	30 lb/ton of pulp (est)	20 lb/ton of pulp	250 $\mu g/m^3$ max 24 hour	167 $\mu g/m^3$ max 24 hour	PRIMARY: 365 $\mu g/m^3$ max 24 hour
Boiler	206 lb/kgal of oil	160 lb/kgal	51 $\mu g/m^3$ max 24 hour	40 $\mu g/m^3$ max 24 hour	SECONDARY: 260 $\mu g/m^3$ max 24 hour (Primary Standard)
Total			30 $\mu g/m^3$*	207 $\mu g/m^3$	

*Assume boiler and process outputs are additive.

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